

**Social Differentiation among Commoners at Erlitou: A Household
Archaeological Perspective**

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Consecutive field excavation from 1959 has exposed an ancient urban settlement and a capital site of the first territorial state at Erlitou, China. In order to better our understanding of the complex society in the Erlitou state, this research investigates 34 household units excavated in 1999-2006 to see how the Erlitou commoners interacted and contributed to the whole community.

A set of 19 variables was used to characterize the artifact assemblages of these 34 households and was the basis of a multi-dimensional scaling analysis in order to investigate social differentiation in four principal dimensions within the household sample. This analysis suggests that Erlitou commoner household units were not just an undifferentiated mass but experienced detectable wealth differentiation, prestige differentiation, ritual differentiation, and productive differentiation, although, compared to the Erlitou elites, the Erlitou commoners were indeed plain, less prestigious, and mundane, although there were some opportunities for them to engage in entrepreneurial activities.

These findings offer a new window to look at the commoners' life in the Erlitou territorial state. The commoners could accumulate some wealth through their emphasis on certain productive activities and thus better their standard of living. Some of them were especially engaged in agricultural activities and some of them were especially involved in other household-based production so that they contributed to the Erlitou economy through the production of daily necessities and craft goods and/or extra food to support the whole community, thus augmenting

the workshop-based production and food tribute from the hinterland commonly supposed to be main elements in the Erlitou economy. Some of the commoners were slightly more prestigious than others and the commoners had some modest access to divination, although they were still in the low range of the whole prestige spectrum and excluded from most ritual activities and duties.

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1.0 Introduction

1.1 The Erlitou State

Before the second millennium BC, the Longshan period (3000-2000 BC) in the Yellow River Valley was replete with competitive interactions. An array of regional polities, Liu and Chen (2012) argue, formed as chiefdom-level early complex societies competing violently with each other indicated by the walled settlements. By the first half of the second millennium BC, the Erlitou period (1735 BC ~ 1530 BC) in the Central Plains witnessed the decline of the warring factions competing for military and economic dominance. One much larger-scale polity, centered at the Erlitou site in the Yiluo Basin, formed, and reorganized the political landscape in north China (Xu 2012). In contrast to the Longshan fortified political centers, the Erlitou site was an unfortified primary capital. Xu (2018) believes the lack of fortifications is because competition lessened as the number of peer polities declined, and the defensive system in peripheral regions secured the unfortified Erlitou and its second-tier centers in the Yiluo basin. The Erlitou polity has been argued to mark the beginning of the Chinese Bronze Age, and is deemed as the first territorial state (Xu 2009, 2014, and 2022; Lee 2004; Liu and Chen 2003 and 2012) or as very close to the state (Shelach-lavi 2015; Shelach and Jaffe 2014).

There were two population surges in the Luoyang Basin, concentrating population in this place, according to surveys here (Liu, Chen, Lee, Wright and Rosen 2004; Zhongguo 2005). The first population explosion happened during the Yangshao period. According to Qiao's estimate (2010), the population living in the Yiluo Valley increased to 4447 by the end of Yangshao from 131 in the Peiligang period. Drennan (personal communication) estimates the population in the

whole Luoyang Basin (much larger area than the Yiluo survey zone) at 135,000 by the end of Yangshao, up from about 1700 in Peiligang. The second population explosion occurred during the Erlitou period. Lixin Wang (2006) notes that what is now western Henan, centered at the Luoyang Basin and along the Songshan Mountains, witnessed a rise both in number and size of settlements in the Erlitou period. Population estimates for the Yiluo survey (Qiao 2010) are up to 7011 during the Erlitou period. Among the new sites, the Erlitou site dramatically enlarged to 540 hectares (Zhongguo 2005). The process of urbanism started in phase II, and reached its peak in phase III, with a population estimate ranging from 18,000 – 30,000 (Liu and Chen 2003) up to as high as 50,000 (Drennan, personal communication). Several archaeologists have argued that a complex settlement hierarchy with four tiers was established in the Erlitou polity (Liu, Chen, Lee, Wright and Rosen 2004; Lee 2004; Zhongguo 2019; Zhongguo and Zhongaomei 2019). Correlated with the Erlitou settlement pattern, Lee (2004) argues that the Erlitou state established territorial control, as indicated by its second and tertiary centers that served to regulate the tribute economy. In a word, the population was very strongly concentrated in the Luoyang Basin even though there were no walled towns in the survey area during the previous Longshan period.

Chang (1983) argues that initially power was based on a monopoly of access to the spiritual world and ancestral sacrifice. In order to maintain exclusive access to ritual activities, the apical elites began to pursue the control of valuable and exotic resources, such as metals and jade which were made into special ritual paraphernalia (Chang 1983; Liu 2003; Liu and Chen 2012). Recent findings in Erlitou indicate that the scapula of cattle, sheep, pig, and deer were commonly used at Erlitou in divination rituals (Zhongguo 2019), although this practice and the techniques of bone preparation are believed by some (Shelach-Lavi 2015: 192) not to originate at Erlitou. Bronze vessels used in ancestral sacrifice were manufactured in a workshop near the palatial enclosure.

Such proximity may indicate a state/elite-controlled industry, as suggested by many scholars (Campbell 2014; Liu 2003). Primary deposits of ritual sacrificial remains, pairs of above-ground circular altars and subterranean rectangular ritual structures are extremely abundant in and to the north of the palatial enclosure (Zhongguo 2003 and 2019). All of these imply the sacrifices and ritual activities were only accessed by the elites.

Aggrandizers, after achieving power and authority, displayed their social status by the exclusive consumption and distribution of the prestige and ritual goods. Jade artifacts were used for communication to the supernatural world since the late Neolithic (Liu 2003). The Erlitou polity continued the usage of jade artifacts and enlarged the prestige and ritual goods assemblage with bronze and pottery vessels. Prestige and ritual artifacts circulated among the Erlitou elites as the indicator of identity and social status and power (Chen 2008; Hao 2008; Li, Z. 2008). The elites were buried with some prestige goods after they died. A four-level burial hierarchy has been proposed by Zhipeng Li (2008; Zhongguo 2019). White pottery ritual vessels are argued as secondary prestige goods and to be circulated among the lesser regional elites, integrating them into the Erlitou polity and building broad power networks (Liu 2003; Nishie and Kuji 2006; Tokudome 2015), indicating the political influence of the Erlitou state in the Late Erlitou period. Liu and Chen (2012) propose that the elites carried out military expansion to ensure access to copper, salt and other resources used to sustain the authority and political connections. Archaeologists agree that Erlitou was a large territorial state, although there is considerable disagreement about how large it was.

A walled enclosure with an array of large-scale rammed-earth structures, dating to the Erlitou period, is unique to the Erlitou site. The wall encircled an area of 11 ha within the city (Xu 2009 and 2022). The energy-cost of construction, indicated by the scale and the building technique,

have led to the claim that these structures were the early palaces (Zhongguo 2003 and 2019; Xu 2009 and 2022; Liu and Chen 2012). Most of the palaces were composed of walls and corridors on four sides, a principal building, and a courtyard in front of the principal building. All the palaces were built on rammed-earth platforms. Thus far, 12 palatial structures have been identified inside the major enclosure, comprising two complexes (Zhongguo 1999, 2014, and 2019). Although these rammed-earth structures have been called palaces, their functions and nature are still debated. Zou (1980) and Tu (1987) have argued that they were not only the Erlitou rulers' residences but also ancestral temples because of the intimate relations between the luxury tombs, sacrificial remains and the large-scale rammed-earth structures. Du proposes that the No. 1 palace was one of the ruler's administrative structures (Du 2005), the No. 2 palace was an ancestral temple (Du 2007a), and the No. 4 palace was a ritual/ceremonial structure (Du 2007b).

Workshops, specializing in bone-tool-making, bronze-casting, and turquoise-processing, have been found at Erlitou (Zhongguo 2019). Two are interpreted as state/elite-controlled bone tool workshops producing personal ornaments (hairpins) and weapons (arrowheads), one in the palatial enclosure and the other next to the sacrificial area to the north of the palatial enclosure (Chen and Li 2016). South of the palatial enclosure, another walled area has turquoise-processing and bronze-casting workshops. The bronze-casting workshop with an area of 1.5 to 2 ha is located in the south of this enclosed workshop complex. Multiple evidence for casting bronzes has been identified, including pottery molds, copper slag, crucibles, and kilns for baking molds (Zhongguo 2003 and 2019). In contrast to contemporaneous polities, the Erlitou polity was the first to apply the piece-mold technique for casting bronze vessels. Craftsmen started to use multiple kinds of alloys when manufacturing bronzes, although they were still exploring the best formula for bronzes (Zhongguo 2014). The turquoise-processing workshop is located to the north of the bronze

foundry. Large numbers of raw turquoises, half-finished artifacts, waste, and processing tools were found there. The technique of inlay had already been used in turquoise processing (Chen, F. 2006). Erlitou received the copper ore and raw turquoise from different places (Zhongguo 2019). Liu and Chen (2012) have argued that Erlitou expanded to the west and south with the goal of ensuring the supply of valuable metals. Thus, the workshop complex and the long-distance transportation of the raw materials are interpreted as a state/elite-sponsored industry (Xu 2009 and 2022; Liu and Chen 2012; Zhongguo 2019).

1.2 Social Hierarchy in the Bronze Age of China

Clans, lineages and family were important nodes in ancient Chinese polities during the Bronze Age (Chang 1983; Lu and Yan 2005). A lot of studies have revealed that family-lineage system contributed much to the administration and governance of the Shang state and the Western Zhou state (Zhu 2004; Li, F. 2008, 2013, 2022). Feng Li (2008, 2013, 2022) called the Western Zhou state a “delegated kin-ordered settlement state”. The regional delegates were the heads of the Western Zhou royal lineage or some heads from the royal marriage partners’ lineages. The Western Zhou state was organized through the kinship structure of lineage which supported political power (Li, F. 2008). The Shang state was argued as an aggregation of self-governing communities, which shared a common cultural background (Li, F. 2008, 2013, 2022). Not only the Shang royal families but also the local groups were organized by the family-lineage system. Both the elites and commoners were combined by the blood lineage and in the hope for being blessed by their ancestors (Allan 1991; Reinhart 2015). Settlement studies on the Yinxu, Anyang have demonstrated that multiple families/lineages occupied Anyang during the Shang period, and they

probably formed family occupational neighborhoods represented by the residential data and the mortuary data in the vicinity of the palace/temple complexes at Yinxu (Zheng 1995; Tang 1998, 2004; Campbell 2018; Wang and Jing 2020). The social hierarchy was found within families/lineages through the mortuary data at Yinxu, Anyang; those elites, no matter how pronounced, were probably the heads of each level of the lineages, and the commoners in each family/lineage also displayed differentiation in different dimensions (Zhu 2004). Thus, the internal social differentiation of a lineage, happened in Shang and Western Zhou, probably formed elites by the different level of heads of the lineages and the heads of the sub-branches of the lineages, and commoner families which could comprise the large portion of each lineage also displaying differentiation in different aspects. The family-lineage system and political power were tightly combined (Lu and Yan 2005; Zhu 2004; Li, F. 2008, 2013, 2022; Campbell 2018). Recent works after 2006 have found that there were residential blocks forming the Erlitou city plan in the shape of “#” and surrounding the Erlitou palatial enclosure, and these residential blocks were enclosed by walls just like the palatial enclosure and the workshop enclosure. Zhao (2020) argues that the new findings on the settlement plan possibly suggest that each Erlitou enclosed residential block was occupied by a family or lineage.

There have been many attempts to reconstruct the Erlitou social structure, from mortuary practices to different residences. Such studies indicate that there were multiple social levels in the Erlitou state. Zhipeng Li (2008), based on burial goods and tomb size, argues there were four levels in the mortuary system, interpreting them as middle and lesser elites, commoners, and human sacrifices. Meanwhile, some archaeologists (Xu 2009 and 2022; Zhongguo 2019) reconstruct social structure from residences, assuming different social level groups lived in different types of buildings; the kings and their wives possessed the large-scale rammed earth structures within the

palatial enclosure, the middle and lesser elites lived in the medium and small above-ground rammed earth structures outside of the palatial enclosure, and only the semi-subterranean structures belonged to the commoners.

Non-elite, or commoners, comprise a large portion of the society. Archaeologists are quite ready to see the commoners as “impoverished”, “unempowered”, and “anonymous”, compared to the elaborateness of the elites (Lohse and Valdez 2004). Commoners are frequently seen as homogenous (Marcus 2004). Because of this “top-down” perspective, commoners get little attention. However, commoners are very important. In a complex society, commoners were the primary adapters to their social environment and were the main producers of food and many other goods (Lohse and Valdez 2004). The functioning and maintenance of complex society requires the fulfilment of social duties and the support of commoners. Dai (2006 and 2010), after investigating the pottery production in the center sites of Dongguan 东关 and Nanguan 南关 in the Yuanqu basin, North-Central China, argues that, during the Longshan period and Erligang phase, the specialized potter commoners produced the daily ceramic vessels for the local elites and other residents and for possible exchange in some long distance and some production could happen in the household-context workshop. Commoners also conducted the most the subsistence production and supported the daily needs of the prestigious and ritual elites. Ran (2022) has found that the rural commoner households in the Hongshan core zone were more involved in food production compared to other Hongshan communities and contributed to feeding the ritual-focused residents (possibly ritual elites) around the Niheliang ceremonial structures.

Meanwhile, class is fluid, although relatively stable and predefined most of the time. Class also exists at multiple levels, shaped by multiple social relations. Thus, individuals can negotiate their identity within a society (Blackmore 2016). For example, a royal court may have a king

surrounded by courtiers, nobles, and those of lower rank (Inomata and Houston 2001). Such low-ranking court members may gain their influence and access to privilege in administrative systems and political organization. Commoners are also heterogeneous. Looking into differentiation among commoners also reveals how the commoners fit into the complex social network.

However, even though multiple studies have acknowledged the complex social differentiation in the Erlitou state, most studies still focus on the Erlitou elites, especially the ruling class. They investigate and discuss the social, political, and economic life of the elites, depicting their luxurious and elaborate life and how they maintained and exercised their political power (e.g. Liu 2003; Nishie and Kuji 2006; Chen 2008; Shelach-Lavi 2015; Tokudome 2015; Xu 2012, 2014, 2016a and 2016b). But we have gained little knowledge about the Erlitou commoners. There is a lot to be learned about how commoners lived in the state, in what ways they interacted with each other, and what they contributed to the Erlitou community. This study focuses on social differentiation to assess how heterogeneous the commoner residents were in the Erlitou state.

1.3 Dimensions of Social Differentiation

The research presented here investigates a sample of the likely bottom-level household units or commoner households from three locations, and studies differentiation within this sample, along several separate dimensions: wealth differentiation, prestige differentiation, ritual differentiation, and productive differentiation (Drennan and Peterson 2012). Archaeological evidence of these kinds of inter-household differentiation comes from the assemblages of artifacts recovered in association with different household units (Peterson, Drennan, and Bartel 2016).

Wealth differentiation refers to the different accumulation of material wealth in different households (Drennan and Peterson 2012). High-value utilitarian craft items, personal adornments made of different materials, and nonutilitarian wealth items usually serve as a good indication of wealth. The volume of storage can also sometimes indicate the wealth.

Prestige differentiation relates to respect (Drennan and Peterson 2012). Wealth accumulation and distinguished ritual status could lead to prestige differentiation in some polities, but this is not necessarily the way it works. Feasting is often a means to gain this respect and then, contribute to prestige. A greater quantity of serving vessels (or other indications of ceremonial feasting) lead to the statement of high prestige. In Bronze Age China, the more prestigious often possessed more drinking vessels and high-quality serving vessels, made from pottery and sometimes even made from metals.

Ritual differentiation concerns access to the supernatural in human society and access to ritual/ceremonious paraphernalia which were used in religious activities and displayed ritual differentiation. In addition, proximity to the locations of ritual activities may also contribute to the ritual differentiation.

Productive differentiation often occurs between households and is quite a different thing from the elite-oriented workshops for producing luxury or special goods. It is usually in the realm of the utilitarian economy for mundane goods used in daily life. Such utilitarian economic activities involved subsistence production, making tools of wood, bone, or stone and producing utilitarian goods such as ordinary pottery, basketry, textiles, etc. It involves differences in the balance of productive activities between different households which then exchange their different products and become interdependent (Drennan and Peterson 2012). The archaeological indicators of productive differentiation of this sort include production debris and especially lithic implements.

1.4 Delineating the household units that compose the household sample

Household has become a topic in Chinese archaeology to understand the prehistoric society in ancient China. Some investigate the wall construction material for housing and floor area to identify the differences in social status (Underhill 1994), some estimate the population size by the number and floor size of house buildings in one site to understand the adaptive strategy of the whole community (Shelach 2006; Shelach et al. 2011), and some others investigate the household assemblages to figure out what kind of economic activities the households practiced and even further to understand the social differentiation within the community (Liu 2004; Peterson & Shelach 2010 & 2012; Drennan et al. 2017; Underhill et al. 2021; Ran 2022). By separating the wall construction materials into adobe, wattle and daub, mud and straw, and earth, Underhill (1994) argues the status differentiation, especially household wealth, along the Yellow River in Longshan period became more and more common displayed by the housing structures and such differentiation in housing would be more exhibited in the major center than the minor centers. After estimating the population size of Zhaobaogou 赵宝沟 by looking into the housing living floor and studying the household assemblages inside of the structures, Shelach (2006) found that the larger average house size shared by the Zhaobaogou people compared to the Yangshao people in Jiangzhai 姜寨 was probably because Zhaobaogou people did household activities indoors while the Yangshao people in Jiangzhai did the household activities externally. Such indoor practices suggest the Zhaobaogou people were more self-sufficient and less interdependent compared to the more communal orientation in Jiangzhai (Shelach 2006). By comparing the number of artifacts and the possible gender relation in these artifacts found in 19 well-preserved houses from Jiangzhai, Dahecun 大河村, Huanglianshu 黄楝树, Yuchisi 尉迟寺, and Yinjiacheng 尹家城, Liu (2004)

argues that household material possessions increased in quantity throughout the Neolithic period, suggesting the development of social complexity and there was an increasing labor division according to gender. Meanwhile, Liu (2004) also discusses importance of the ritual feasting in cooperation by a Kangjia 康家 household-group context formed by an extended family composed of 33 superimposed houses. Underhill and co-workers (2021) explore cooperation in tool production, and lithic raw material acquisition among the households in Liangchengzhen 两城镇 site.

However, most of the previous work focused on Neolithic communities. Although Shelach and co-workers (2011) talk about the function of the fortifications, and the strategies of integration and defense of the local people at Sanzuodian in the Bronze China with population estimates based on number and size of dwellings, more work is still needed to understand the commoners' life and the role of commoner households in a local community during the early Bronze Age of China. There are some works about the commoners and the development of social complexity through the lens of households along the Yellow River during the Neolithic in China. Attempts are also required to study the commoners through the lens of households along the Yellow River in Bronze age China and understand how the commoners lived and contributed to the communities in the ancient state.

Since house structures, associated features, and artifact assemblages in household garbage all represent the status and daily life of the residents, social differentiation can be studied with this evidence. This research takes a sample of household units at Erlitou, some with structural and artifact evidence, and some with only artifact evidence. The overall object of the research presented here is to reconstruct the social differentiation within and among the bottom-level groups or commoners at Erlitou through this sample of households.

The data come from the 1999-2006 season excavation in the Erlitou site, carried out by the Erlitou archaeological team, Institute of Archaeology, Chinese Academy of Social Science (Zhongguo 2014). A total of 8963.89 square meters have been excavated between 1999 and 2006, besides a full-scale systematic coring survey. Most of the excavation was conducted within the palatial enclosure and the northern part of the workshop enclosure, and there was also some work in the east end of the site (Figure 1.1). The research presented here samples the household data from these three locations, and codes the household sample in or near the palatial enclosure with “G”, the household sample in or near the workshop enclosure with “W”, and the sample from the east end of the site with “D”.

According to the published report – *Erlitou: 1999-2006* (Zhongguo 2014), 21 small housing structures have been found. They lasted from the Erlitou period to the Erligang period, when the Erlitou state was defeated and superseded by the Erligang state (Zhongguo 2014, 2019). Although poor preservation makes it hard to discern the floorplans of these small houses, some of the small houses can still indicate whether they are above-ground or semi-subterranean houses (Xu 2009 and 2022; Zhongguo 2014 and 2019). Of the 21 small houses, eleven are found in the palatial enclosure, six are in the workshop enclosure, and four are in the east end of the site.

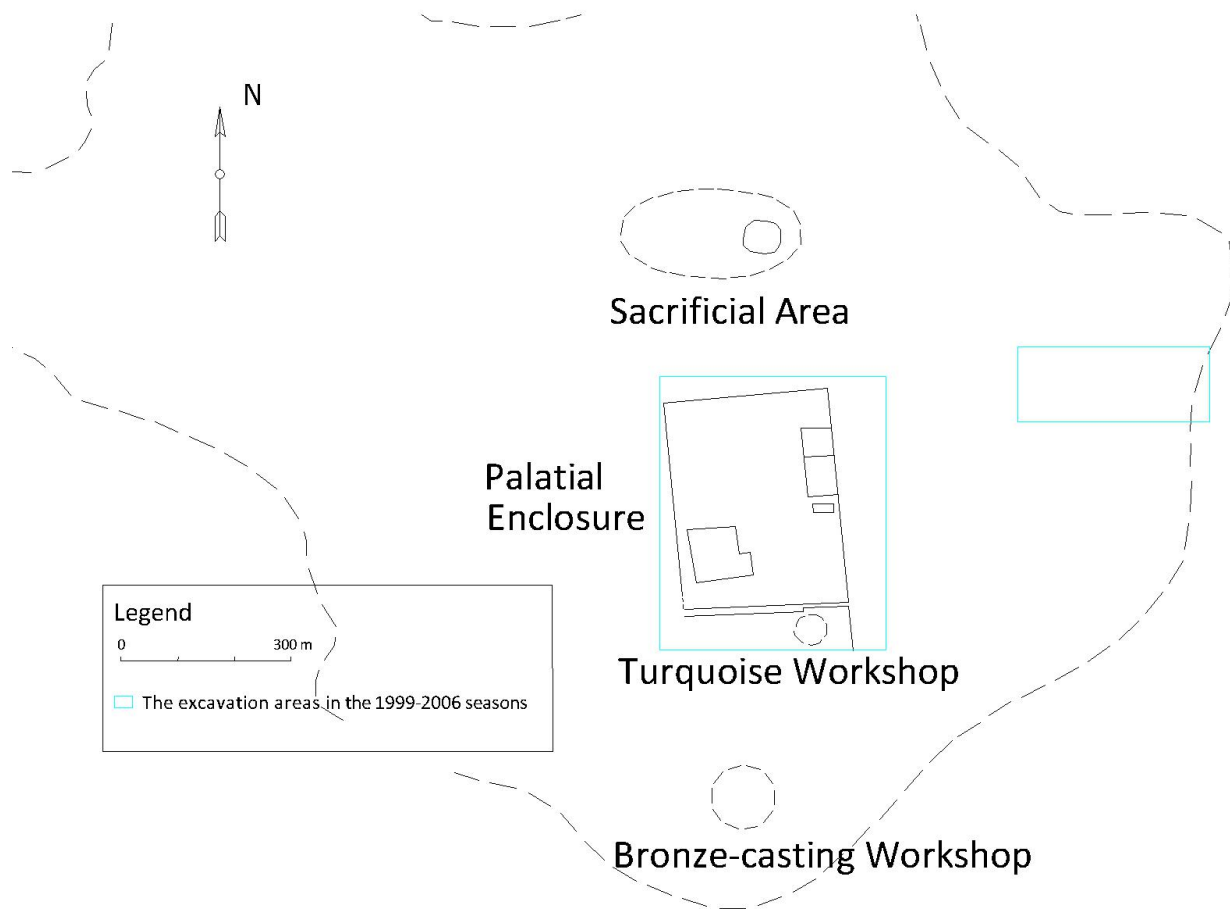
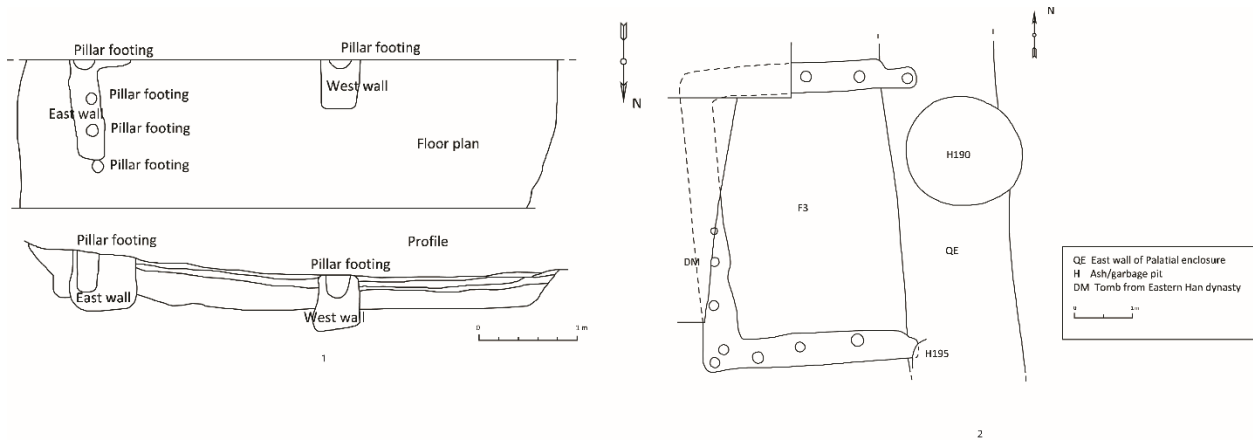


Figure 1.1 Plan of the Erlitou site and the excavation in the 1999-2006 seasons (modified from *Zhongguo* 2014, Figure 1-1-3-3, pp 7)

Small housing structures include above-ground houses and semi-subterranean houses. Such housing structures have been seen since the Neolithic along the Yellow River valley. Some of the small above-ground houses may have rammed earth footings and some small above-ground houses may be established directly on the ground (Yang 2008; Li 2007). The cases in the Erlitou site indicate that this form of housing structure could have wooden wall structures plastered with mud (Figure 1.2). Semi-subterranean housing structures were a pit with its living floor rammed and baked, and roof covered by mud and straw (Yang 2008). Round- and square-shaped semi-subterranean housing structures have been seen in the Erlitou site (Figure 1.3).



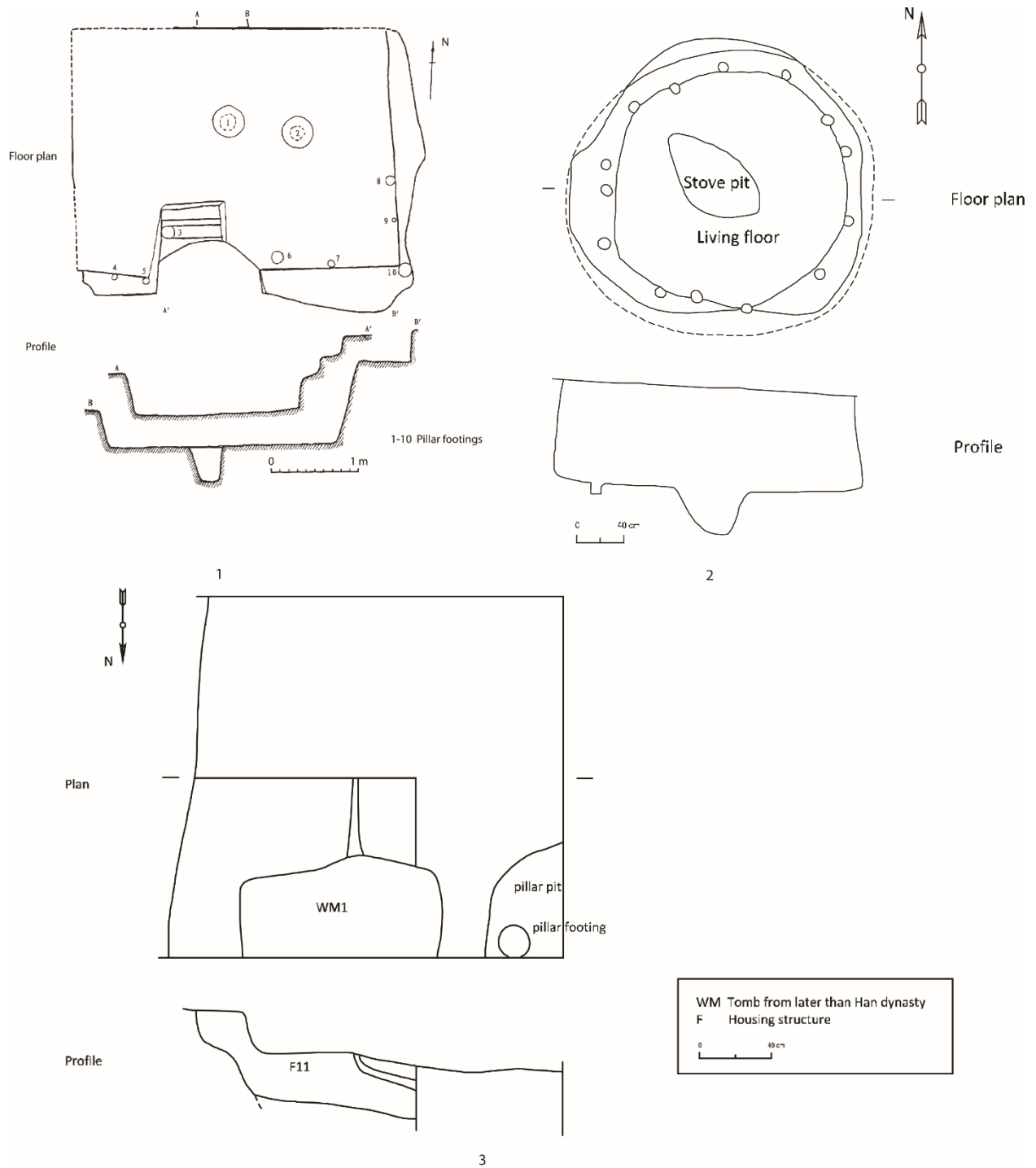


Figure 1.3 Examples of Erlitou semi-subterranean housing structures

(1. modified from *Zhongguo 1999*, Figure 41, pp 77; 2. modified from *Zhongguo 2014*, Figure 6-4-1-1-1, pp 702; 3. modified from *Zhongguo 2014*, Figure 5-4-2-4-1, pp 344)

However, not all the small houses found in the 1999-2006 excavations will be used in this study. Among the eleven small houses in the palatial enclosure, F4, F5, F13, F14, F16, and F17 are not included in this study. F5 was likely to be part of the No.3 large-scale rammed-earth structures, and F13, F16 and F17 were possibly part of the No.6 rammed-earth structure. F4 and F14 are left out because there are no data of the artifact assemblages within the house structure and no adjacent coeval ash/storage pits. Among the six small houses in the workshop enclosure, F8, F12 and F15 are left out from this study. F12 and F15 were destroyed by one another, no assemblage data within them representing the occupational period were present, and there were no coeval ash/storage pits. No ceramic data from the occupational period were available from F8, and no surrounding attached coeval ash pits were present. Thus, F8 is also not included in the statistical analysis although some practical tools were found there. As for the four houses in the east end of the site, F1 and F3 are left out because there are no adjacent coeval ash pits, and no assemblage data. Therefore, the proposed study would focus on 10 household contexts with structural information which are confirmed in the published report (dating from Erlitou Phase II to Late Erligang period), 5 of which are located within or in close proximity to the palatial enclosure, 3 in the workshop enclosure and 2 in the east end of the site. Among these 10 household units, G1/F2 (Figure 1.2:1), G14/F10, G16/F3 (Figure 1.2:2), W3/F9 and D5/F4 are with above-ground housing structures, and G18/F1 (Figure 1.3:2) and W4/F11 (Figure 1.3:3) are with semi-subterranean housing structures, while the other 3 (G9/F6, W1/F7, and D2/F2), although with housing structures, are hard to tell what forms of the housing structures are because of the absence of decisive features.

A household not only includes a house structure, but also combines some surrounding ash/garbage pits. All the artifacts from a house structure and its associated pit features comprise

the household artifact assemblage. Peterson and Shelach (2012), for example, included artifacts from the contemporaneous pit features located near residential structures. Winter (1976) believed that the storage pits within 10 meters to one side of a house attached to that house. Recently, the systematic survey in the Upper Daling region has found that the Hongshan household would occupy an area with a length no more than 20 meters (Peterson, Lu, Drennan and Zhu 2017). This study includes artifacts from the trash pits within a radius of roughly 10 meters around the house structures in the Erlitou site. The 10 household units with housing structures could have some associated ash/garbage pits.

This study also includes 24 household clusters which are represented only by ash/storage pits and their artifacts. This study takes a chain of ash/garbage pits which formed a cluster roughly within a radius of about 10 meters representing a household unit. This household sample represented by only ash/garbage pits are composed of 17 in or near the palatial enclosure, 4 in or near the workshop enclosure, and 3 in the east end of the site. The drilling survey and excavation show that there was an array of borrow pits serving as the east boundary (Zhongguo 2014; Xu et al. 2004). These borrow pits should later become the garbage pits of the surrounding households.

Table 1.1 Relatively well-preserved small houses in the Erlitou site

Code	Area (m ²)	4 m ² / person	6 m ² / person	References
VIIIF1	9.9640	2.4910	1.6607	<i>Zhongguo 1999</i> , pp. 75
IVF1	8.9900	2.2475	1.4983	<i>Zhongguo 1999</i> , pp. 59
IIIF2 ¹	39.7700	9.9425	6.6283	<i>Zhongguo 1999</i> , pp. 160-161

III F1	34.0000	8.5000	5.6667	<i>Zhongguo 1999</i> , pp. 162
80YLVIF1	6.2350	1.5588	1.0392	<i>Zhongguo 1983</i>
82 秋 YLIXF1 ²	Lower: 13.2000	3.3000	2.2000	<i>Zhongguo 1985</i>
	Upper: 11.9000	2.9750	1.9833	
2003III F4 ³	38.6750	9.6688	6.4458	<i>Zhongguo 2014</i> , vol. 1, pp. 213-215; vol. 5, pp. 56
2002VF1	4.9063	1.2266	0.8177	<i>Zhongguo 2014</i> , vol. 2, pp. 701-703; vol. 5, pp. 56
2003VF3	13.0000	3.2500	2.1667	<i>Zhongguo 2014</i> , vol. 2, pp. 705-707; vol. 5, pp. 56
2004VF4 ⁴	4.1527	1.0382	0.6921	<i>Zhongguo 2014</i> , vol. 2, pp. 707; vol. 5, pp. 56

*1. III F2 is coded for a two-roomed house although the western room is still separated by 1.4 m from the eastern room. The eastern room is damaged. The area listed in table 1.1 is only for the western room.

2. 82 秋 YLIXF1 is coded for two housing structures, one of which is superimposed by the other. The lower one is a rectangular-shaped semi-subterranean structure, and the upper one is an above-ground structure built after filling and leveling up the lower one.

3. 2003III F4 was only exposed the eastern part during the 2003 excavation. The area is only the floor area exposed.

4. 2004 V F4 is a round-shaped semi-subterranean structure only exposed the northern half during the excavation. The area is estimated by the bottom diameter.

Table 1.1 shows the floor size of the relatively well-preserved houses found in Erlitou by far. According to Shelach (2006), the residential density in the Zhaobaogou site in the northeastern China was 6 m²/person. However, a slightly higher residential density of 4 m²/person seems to be more reasonable in the central China (Peterson & Shelach 2012). Regardless of 4 m²/person or 6 m²/person, the small housing structures in the Erlitou site were likely to hold a nuclear family, just like the household units in the Neolithic China. So, this study will analyze the artifacts from a sample of 34 nuclear-family households (5 in small above-ground structures, 2 in semi-subterranean structures, and 27 in indeterminate structures) to reveal social differentiation between and among them, understanding the daily life of the bottom-level groups or commoners of the three locations represented by them during the period of the Erlitou state and investigate possible change right after the Erlitou state was defeated. The sampled household assemblages include ceramic sherds, productive tools and debris of stone, bone and other materials, and other artifacts like decorative goods and oracle bones (Table 1.2).

This sample of 34 household units are coded in three groups. Twenty-two household units (coded as “G1/F2 ~ G22”) are in or near the palatial enclosure (Figure 1.4-1.5): 21 are inside of the enclosure and 1 (G1/F2) close to the outside of the east wall of the enclosure. Seven household units (coded as “W1/F7 ~ W7”) are in or near workshop enclosure (Figure 1.6): 6 inside of the enclosure and 1 (W7) close to the outside of the north wall of the enclosure. Five household units are at the east end of this site (coded as “D1 ~ D5/F4”) (Figure 1.7). Additionally, it has to be noted that, unfortunately, I accidentally forgot to count the sherds from 8 ash pits (H308, H309, H310, H311, H313, H349, H368 and H371) which are possibly associated to the W1/F7 when I did the

lab work in 2021. Because of the absence of pottery data from these pits, the non-pottery collection from these pits is not included in the analysis as well.

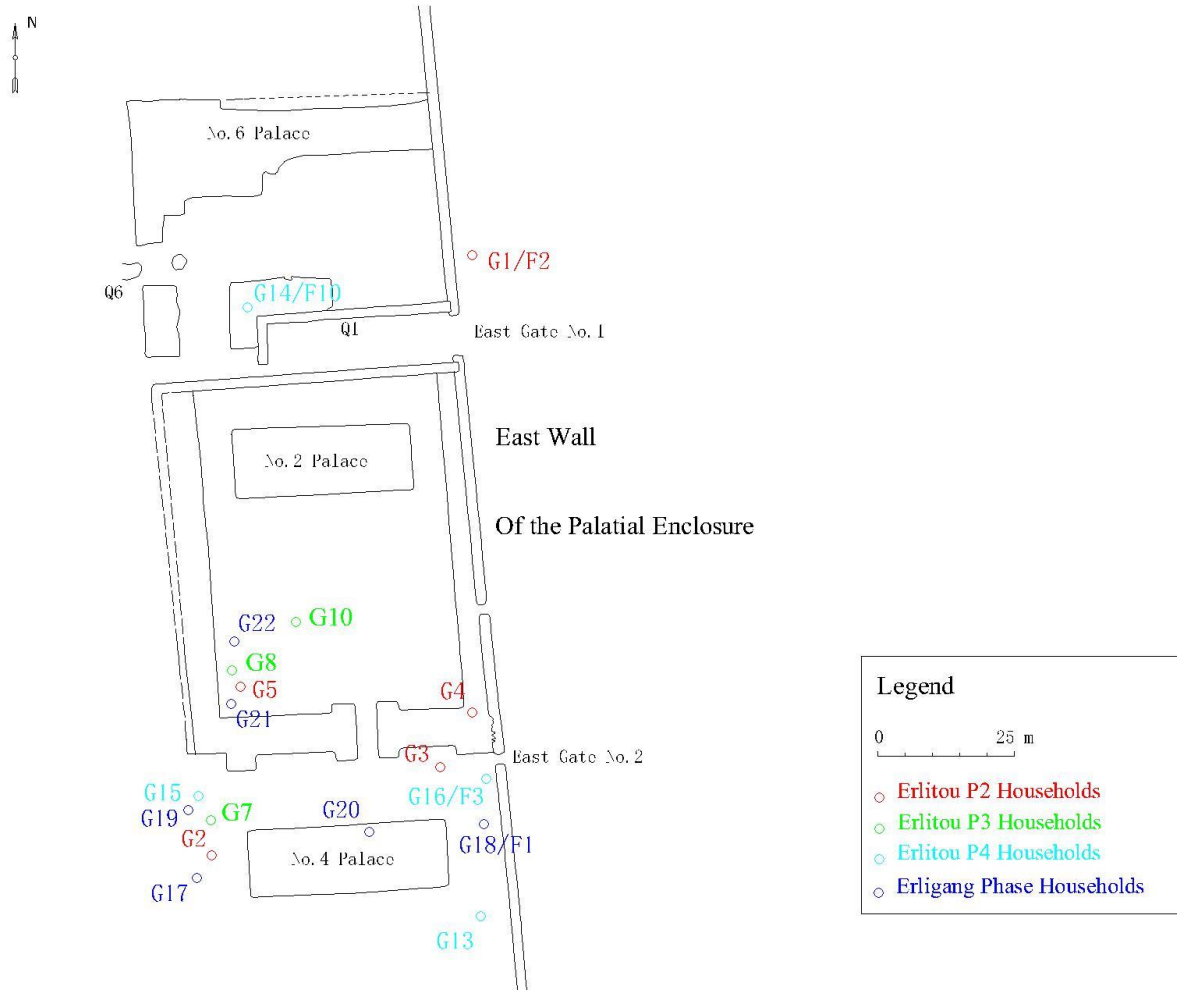


Figure 1.4 Household units in this sample in or near the east complex of the palatial enclosure (modified from *Zhongguo 2014: Figure 5-0*)

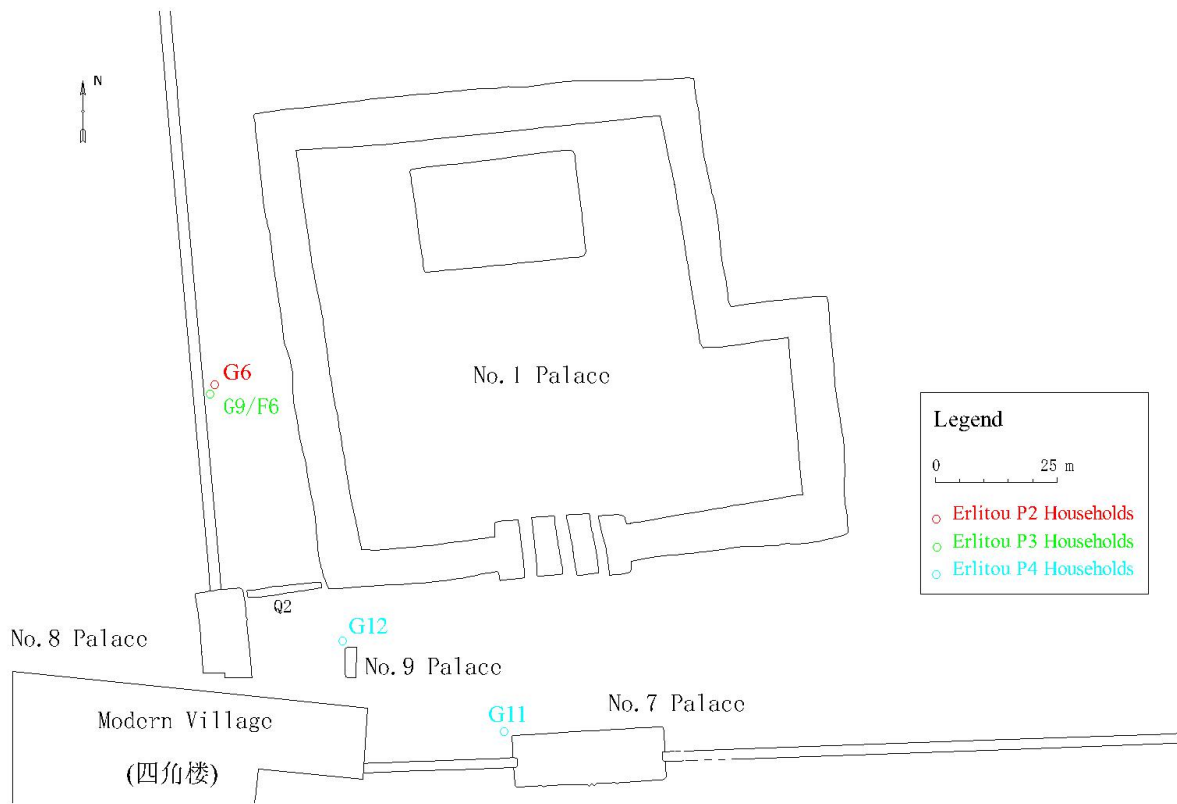


Figure 1.5 Household units in this sample around the west complex of the palatial enclosure (modified from *Zhongguo 2014: Figure 5-0*)

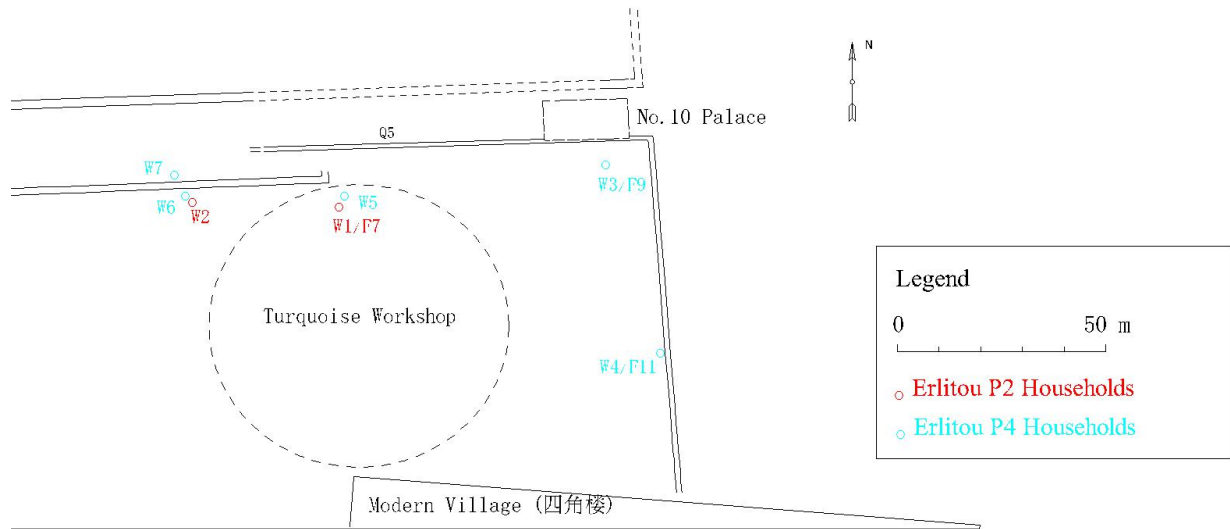


Figure 1.6 Household units in or near the workshop enclosure (modified from *Zhongguo 2014*: Figure 5-0)

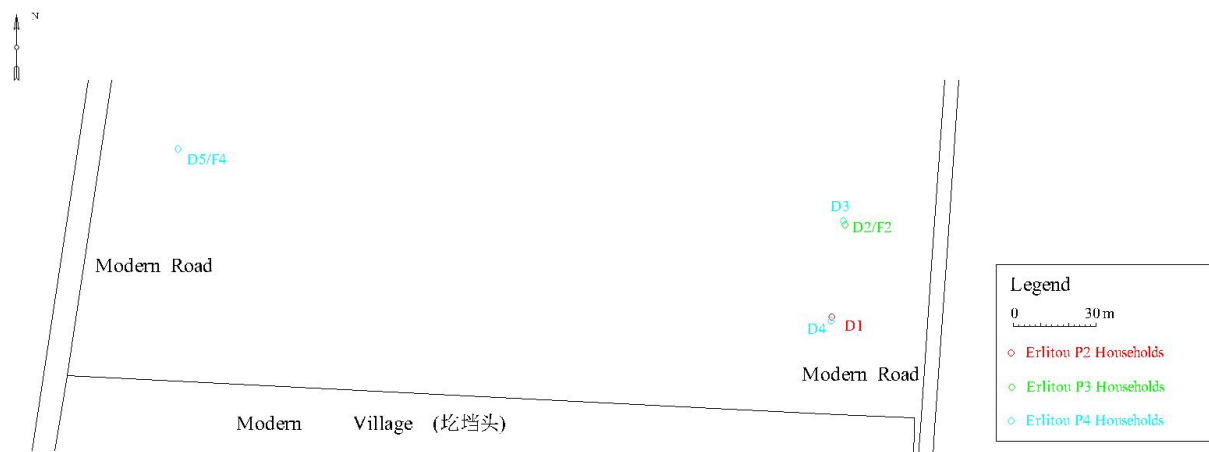


Figure 1.7 Household units in this sample in the east end of the site (modified from *Zhongguo 2014*, Figure 1-1-3-4, pp 8)

1.5 Research Questions

The research presented here is broadly about how a sample of 34 household units interacted in and contributed to the social network of the Erlitou. As their household assemblages are not as elaborate as the expected elites and some of them occupied small houses (small above-ground house structures and semi-subterranean housing structures), they were probably the social

members of bottom level from each of the three locations of the Erlitou site (the palatial enclosure, the workshop enclosure, and the eastern end of the site). Is it accurate to consider them members of different classes? If they all were from different classes, what classes were they from? What sort of differentiation existed within and among the household units from the three locations and how strong was it? Or were they all from the same class, that is, commoners? If they all belonged to commoners, what sort of differentiation existed within the commoners from three locations and how strong was it? In order to answer the questions above, this research presented here investigates the following questions.

1) How much wealth differentiation is detectable among the households in this sample?

Wealth differentiation among the household units in this sample is evaluated through storage of resources, capacity of food preparation and possession of ceramics decorated with incising/stamping in complex patterns and personal ornaments. A wealthier household will possess more correlated artifacts. Since for various reasons there will be samples of very different sizes from the different households, proportions rather than actual counts of sherds of storage vessels, decorated sherds, and personal decorative artifacts will be used. Assessing wealth differentiation enables me to evaluate whether the families living next to the rammed-earth palaces were wealthier people compared to those farther from the palatial enclosure, and whether the people living in the workshop enclosure had more wealth relating to their productive involvement.

2) How much prestige differentiation is detectable among the households in this sample?

Feasting will be good archaeological evidence of accumulating prestige (Drennan and Peterson 2012). Feasting is interpreted as a means to create and maintain a stratified social order, negotiate social status, and enhance solidarity (Pollock 2003). Elaborate vessels would be used to serve and display food and drink (Dietler 2001). Feasting requires serving and drinking vessels to

share food and drinks. Prestigious families tend to consume more ceramic vessels decorated in some ways to serve, share, and store food and drinks. While feasting is often thought of as distinguishing elites from commoners, on a smaller scale it could also be a means of establishing ranking within commoner groups. Shang potters practiced community-based and household feasts which empowered their group and by which the artisans negotiated social power in the Shang dynasty (Reinhart 2015). This research will assess the proportion of feasting utensils and vessels, and the polished and/or finger-nail-incising decorated ceramics to evaluate the prestige differentiation in the household sample.

3) How much ritual differentiation is detectable among the households in this sample?

An array of ritual paraphernalia seen in the Erlitou period demonstrates that there were plenty of forms of religious activities conducted in the Erlitou state. Consumption of different kinds of ritual paraphernalia and the practice of divination with oracle bones would be a good indicator of ritual differentiation. Power is speculated to be based on a monopoly of ritual activities at the very beginning (Chang 1983). During the Bronze age of China, elites are believed to monopolize communication between ancestors and deities, and commoners and other members of the polities relied on the assistance of elites to contact the ancestors and gods (Chang 1989). Oracle divination by scapulimancy was an important ritual activity. Commoners and craftsmen may perform divination activities in their homes and/or workshops with the help of the professional diviners (Chen and Li 2013). Thus, differentiation in access to the divination paraphernalia can demonstrate differentiation in ritual status.

4) How much productive differentiation is detectable among the households in this sample?

Specializations in turquoise and bronze suggest that perhaps Erlitou was a society in which everyone's daily needs came from a large workshop of some kind. In such a situation, only

ubiquitous ordinary activities could occur in most households. Liu (2006) investigates a diachronic settlement-level change in craft specialization at Erlitou, based on the distribution of the six types of productive tools, and proposes there was not only attached craft production, but also independent craft production, and the urban population could acquire some goods from the local community. The research presented here aims to investigate how the Erlitou utilitarian economy worked. Whether and to what extent productive activities were differentiated between households will be studied through the comparison of the proportions of different productive tools in the household artifact assemblages. Farming tools like sickles and shovels, hunting tools / weapons like arrowheads, and sewing tools like awls and needles are often seen in household artifact assemblages. If there was much productive differentiation, it suggests that everything did not come from big workshops, but that there may have been a thriving bottom-up utilitarian economy. If all households had just very similar artifacts for productive activities, then maybe they all produced and prepared food and got their other necessities from big workshops.

- 5) Whatever differentiation is documented in answering the questions above, how much of it seems to differentiate households living in above-ground structures as a group from those living in semi-subterranean structures?

Answering this question helps us to know whether households in above-ground structures are best described as members of a class sharply set off from commoners in semi-subterranean structures.

- 6) Whatever differentiation is documented in answering the questions above, how much of it occurs among households living in above-ground structures and how much among those living in semi-subterranean structures?

The answer to this question expands on the answer to the previous one by exploring the differentiation that existed within either of the two groups.

Table 1.2 Artifact assemblages from the 34 household units

Household unit	Housing structures and garbage pits*	sherds	Lithic artifacts	Bone artifacts	Antler artifacts	Tooth artifacts	Shell artifacts	Bronze artifacts	Turquoise artifacts	Non-vessel pottery artifacts	Oracle bone	Raw material - rock	Raw material - bone	Raw material - antler	Raw material - shell	copper ore and slags	Raw material - turquoise
G1/F2	VF2, VH197, VH202, VH213, VH214	243	3	1	0	0	3	0	0	0	0	5	1	2	0	0	0
G2	VH105, VH125	845	4	1	0	0	2	0	0	2	3	0	1	0	0	0	0
G3	VH182, VH183, VH188, VH192	132 4	1	0	0	0	0	0	0	0	2	0	0	1	0	0	0
G4	VH127, VH129, VH133, VH134	420	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
G5	VH12, VH28, VH32, VH34, VH45, VH255	191 0	2	3	0	1	2	0	0	0	3	0	1	1	3	0	0
G6	VH293, VH295, VH296	218	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0
G7	VH62, VH67, VH99	123 6	2	3	0	0	1	0	0	0	1	2	1	2	0	1	0
G8	VH13, VH14, VH18, VH19, VH22, VH26, VH27, VH36, VH40, VH41	294 7	1	1	0	0	2	0	1	0	1	0	2	0	1	0	0
G9/F6	VF6, VH292, VH294, VH298, VH299	617	0	1	0	0	0	0	0	0	0	2	0	0	1	0	0
G10	VH35, VH37, VH38, VH110	174 8	2	0	0	0	1	0	0	0	1	0	0	0	0	0	0
G11	VH258, VH277, VH327	252	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
G12	VH232, VH236, VH259, VH262, VH270	108 2	1	2	0	0	0	0	0	1	0	1	4	0	0	0	0
G13	VH61, VH128, VH131, VH132, VH136, VH137, VH138, VH144, VH147, VH150, VH168, VH189	358 1	9	12	2	1	3	3	0	2	3	1	16	3	1	6	10

G14/F10	VF10, VH397	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	VH16, VH52, VH53, VH92	268 6	5	10	0	0	3	0	0	0	3	5	5	0	1	0	0
G16/F3	VF3, VH139, VH218, VH219	544	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0
G17	VH77, VH78, VH79, VH98, VH123	186 9	6	2	0	0	3	0	0	5	1	2	1	0	0	0	0
G18/F1	VF1, VH141, VH142, VH190, VH193, VH195, VH205	161 6	7	3	0	0	2	1	0	3	3	0	1	0	0	0	1
G19	VH11, VH47, VH48, VH50, VH65, VH66, VH100, VH122	375 0	15	12	0	0	6	0	0	3	1	6	3	0	0	0	0
G20	VH126, VH154, VH155, VH160, VH162, VH165, VH167	143 7	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0
G21	VH3, VH4, VH5, VH17, VH21	153 6	9	3	0	0	3	0	0	2	0	1	0	2	1	0	0
G22	VH20, VH23, VH25	165 4	2	0	0	0	1	5	0	0	1	0	0	0	0	0	0
W1/F7	VF7, VH306, VH307, VH312, VH315, VH316, VH317, VH320, VH364, VH367, VH370, VH372	163 2	5	4	0	0	1	0	0	1	1	3	4	0	1	0	0
W2	VH274, VH275, VH276, VH281	113 6	4	0	0	2	7	0	0	0	0	0	0	1	1	0	1
W3/F9	VF9, VH332, VH337, VH344, VH358, VH360, VH362	179 5	4	4	0	0	0	0	0	0	0	4	0	0	0	0	0
W4/F11	VF11	103	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
W5	VH252, VH278, VH282, VH283, VH284, VH290, VH300, VH301, VH302, VH303, VH304, VH323, VH330, VH333,	858 2	44	22	1	3	14	1	0	2	9	11	21	0	2	2	408 4

	VH341, VH342, VH343, VH345, VH346, VH347, VH348, VH354, VH355, VH356, VH357, VH369, VH373, VH374																
W6	VH265, VH266, VH258, VH271, VH297	100 1	3	1	0	0	0	0	0	0	0	1	0	2	0	0	0
W7	VH269, VH402, VH403	394	1	2	0	1	0	0	0	0	0	0	0	2	0	0	0
D1	IIIH1, IIIH14, IIIH25, IIIH26, IIIH27	936	3	8	1	0	1	0	0	0	0	6	0	0	0	0	0
D2/F2	IIIF2, IIIH9, IIIH28	437	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0
D3	IIIH4, IIIH7 IIIH13, IIIH23, IIIH35	212 8	12	8	0	0	3	0	0	1	0	15	0	0	0	0	0
D4	IIIH5, IIIH8, IIIH10, IIIH15, IIIH17, IIIH18, IIIH22	271 1	16	1	0	1	3	0	0	2	1	12	4	0	0	0	1
D5/F4	IIIF4	199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*1. Roman numerals are the codes for the site sections. The Erlitou site is divided into 15 sections by the archaeologists according to the modern roads and villages plans. The excavation in the east end of the site during the 1999 – 2006 is in the Section III, and the excavation in the Palatial enclosure and the northern part of the Workshop enclosure during the 1999 – 2006 is in the Section V.

2. F refers to housing structure.

3. H refers to garbage pit.

2.0 Erlitou Household Artifact Assemblages and Multidimensional Scaling

2.1 Multidimensional scaling

In order to answer the research questions, this project chooses multidimensional scaling to analyze the Erlitou household artifact assemblages. Multidimensional scaling is deemed as the “simplest and most intuitive of the various approaches to multivariate analysis” (Drennan 2010). Nonmetric multidimensional scaling is capable of representing the structure in a dataset, in terms of clusters and axes of scalar variation, and the relationships between the cases in the dataset are indicated by such structure (Drennan et al. 2017). If the dataset represents a group of household units from a local community, it offers us a way to study further the relationships in the local community and the emergence and development of complex society (Drennan et al. 2017). Nonmetric multidimensional scaling makes it possible to represent the similarities between the Erlitou household artifact assemblages as a graph in which each point is a household assemblage and more similar assemblages are represented by points closer together, while more different assemblages are represented by points farther apart. The trial-and-error iterative procedure for creating the configuration in the graph positions the points so as to maximize the rank-order correlation between the matrix of interpoint distances in the graph and the measure of similarity between artifact assemblages that is the input to the procedure. The result is that the graphs represent large differences between household assemblages as large distances between the points that represent them and small differences between household assemblages as small distances

between the points that represent them. The structure of points shown by the configuration in the graph can display the relationships between the household units in the Erlitou local community and provide us a better understanding of the Erlitou complex society. Multidimensional scaling is based on a codification of relevant variability in the artifact assemblages which are transformed into a defined set of variables.

In order to get meaningful and interpretable configurations, one of the important factors for multidimensional scaling is the number of variables, which are used to measure the similarity scores and distances between cases. If the number of variables is too many, there is substantial risk of finding fallacious patterns because of the random noise in the data; if the number of variables is too short, there is also huge possibilities of finding patterns that miss the meaningful information and cannot help the interpretation. A rule of thumb for multidimensional scaling is that the number of variables should be no more than about half the number of cases (Drennan 2010).

2.2 The 19 variables for multidimensional scaling

During the 1999 - 2006 excavation seasons, archaeologists have found a large array of remains at Erlitou. The remains include sherds, practical tools, ritual paraphernalia, and other types of artifacts. According to the attributes of those household assemblages, this study carries out the multidimensional scaling with a variable set of 19 variables (Table 2.1). The data of the 34 household units under the 19 variables are shown in Table 2.2.

Table 2.1 List of 19 variables

Variable 1. Fingernail incising	number of sherds with fingernail incising divided by the total number of sherds for each household
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Variable 2. Incising/stamping in complex patterns	numbers of sherds with incising/stamping in complex patterns divided by the total number of sherds for each household
Variable 3. Polishing	number of polished sherds divided by the total number of sherds for each household
Variable 4. Feasting utensils and vessels	number of feasting utensils and vessels (<i>bi</i> , bowls, plates, cups, and pitchers) divided by number of sherds of identifiable vessel forms for each household
Variable 5. Storage vessels	number of storage vessels (jars, vats, and basins) divided by number of sherds of identifiable vessel forms for each household
Variable 6. Food preparation artifacts	number of food preparation artifacts (grater-bottom bowls, pestles and mortars) divided by number of sherds of identifiable vessel forms each household
Variable 7. Ornaments	number of ornaments (hairpins, beads, circles, and turquoise sheets for inlay) divided by number of sherds of identifiable vessel forms for each household
Variable 8. Carpentry/construction tools	number of carpentry/construction tools (axes <i>fu</i> , adzes, spades, and saws) divided by number of sherds of identifiable vessel forms for each household
Variable 9. Agricultural tools	number of agricultural tools (knives, and sickles) divided by number of sherds of identifiable vessel forms for each household

Variable 10. Textile tools	number of textile tools (awls, needles, spindle whorls) divided by number of sherds of identifiable vessel forms for each household
Variable 11. Weapons/hunting tools	number of weapon/hunting tools (axes - <i>yue</i> , and arrowheads) divided by number of sherds of identifiable vessel forms for each household
Variable 12. Resharpener tools	number of resharpening tools (whetstones) divided by number of sherds of identifiable vessel forms for each household
Variable 13. Fishing tools	number of fishing tools (darts and net sinkers) divided by number of sherds of identifiable vessel forms for each household
Variable 14. Ritual paraphernalia	number of ritual paraphernalia (oracle bones and hollow-bottomed vessels) divided by number of sherds of identifiable vessel forms for each household
Variable 15. Lithic production	number of lithic cores, flakes and blanks divided by number of sherds of identifiable vessel forms for each household
Variable 16. Bone production	number of bone cores, blanks and wastes divided by number of sherds of identifiable vessel forms for each household
Variable 17. Antler production	number of antler cores, blanks and wastes divided by number of sherds of identifiable vessel forms for each household
Variable 18. Shell production	number of shell blank/wastes divided by number of sherds of identifiable vessel forms for each household

Variable 19. Bronze working	number of copper ores (or ore shatters), and slags divided by number of sherds of identifiable vessel forms for each household
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Sherds make up the largest proportion of the assemblages. A lot of pottery vessel forms have been identified in the Erlitou site and generally are categorized into cooking vessels, vessels for wells, storage vessels, food preparation vessels, serving vessels, drinking vessels, and miscellaneous vessels (Zhongguo 1995 and 2003). This study specifically focuses on and investigates storage vessels, drinking vessels, serving vessels and food preparation vessels. On the other hand, some sherds have been picked from the general collection, pieced together, and published as specimens of certain forms in the report (Zhongguo 2014). This study also includes these published specimens, and the white pottery sherds from the correlated household garbage pits published in the appendix tables of the archaeological report (Zhongguo 2014: Volume 5, Appendix table 9-5A and 9-5B, pp 287-309), counting them each as one sherd under certain categories. The sherds, if collected from the footings or wall footings of some housing structures according to the report, are probably not from the period of such housing structures occupation so they are not included in this study. Many sherds, of course, are too small to show the defining characteristics of any particular vessel form, and some are not known for their functions after piecing together, so these were counted as “indeterminate form”. The storage vessels, serving vessels, drinking vessels, food preparation vessels in addition to cooking vessels, vessels for wells, and miscellaneous vessels are all identifiable vessel forms. The sample size of the total sherds of the 34 household units ranges from 76 to 8582, and the sample size of the sherds of identifiable vessel forms of each household units ranges from 34 to 6917.

Practical tools of stone, bone, antler, shell, and bronze are another group of artifacts that can be seen in the collection from the 1999 - 2006 excavation and are published in the archaeological report (Zhongguo 2014). In order to investigate what economic activities these households were involved with, this study categories the practical tools into construction/carpentry tools, agricultural tools, textile tools, weapon/hunting tools, resharpening tools, and fishing tools. Some lithic, bone, antler, shell, and bronze items, published under the name of broken artifacts (*canjian* 残件), only show the artificial features without defining characteristics of any particular tool/artifact form, so they were considered by this study as “indeterminate lithic items”, “indeterminate bone items”, “indeterminate antler items”, “indeterminate shell items” and “indeterminate bronze items”. Tooth artifacts (*yaqi* 牙器) were only shown the artificial features without defining characteristics of any particular tool/artifact form so that this study also considers them as “indeterminate tooth items”. The indeterminate items in different materials are not included in any category of practical tools. Other remains seen in the household context include raw materials in stone, bone, antler, shell, and turquoise, which are also published in the archaeological report (Zhongguo 2014). Such raw materials may represent household-level artifacts or tools production.

Variable 1. Fingernail incising

Many papers have found that the pottery vessels with exquisite decorations were probably an indicator that the possessors of such pottery were associated with high rank in the society. Fingernail incising (*zhijia wen* 指甲纹) is often seen on the pitchers, jars, and vessel covers (*qigai* 器盖). It also can be seen on bowls. Generally, fingernail incising is often applied to the shoulder of a vessel (Figure 2.1). Although there is no specific statistics on the rate of sherds/vessels decorated with fingernail incising, some archaeologists find the vessels with all kinds of incising

patterns only taking up 2.6% in Erlitou Phase 1, 4.5% in Erlitou Phase 2, 4.8% in Erlitou Phase 3, 3.5% in Erlitou Phase 4 among the piecing together vessels found during 1959 - 1978 excavations (Zhongguo 1999). Because of the rarity of the finger-nail incising seen on the Erlitou pottery vessels and being time-consuming to apply it on the pottery vessels, especially on the storage vessels or drinking vessels, it could be argued to connect most with either wealth or prestige.

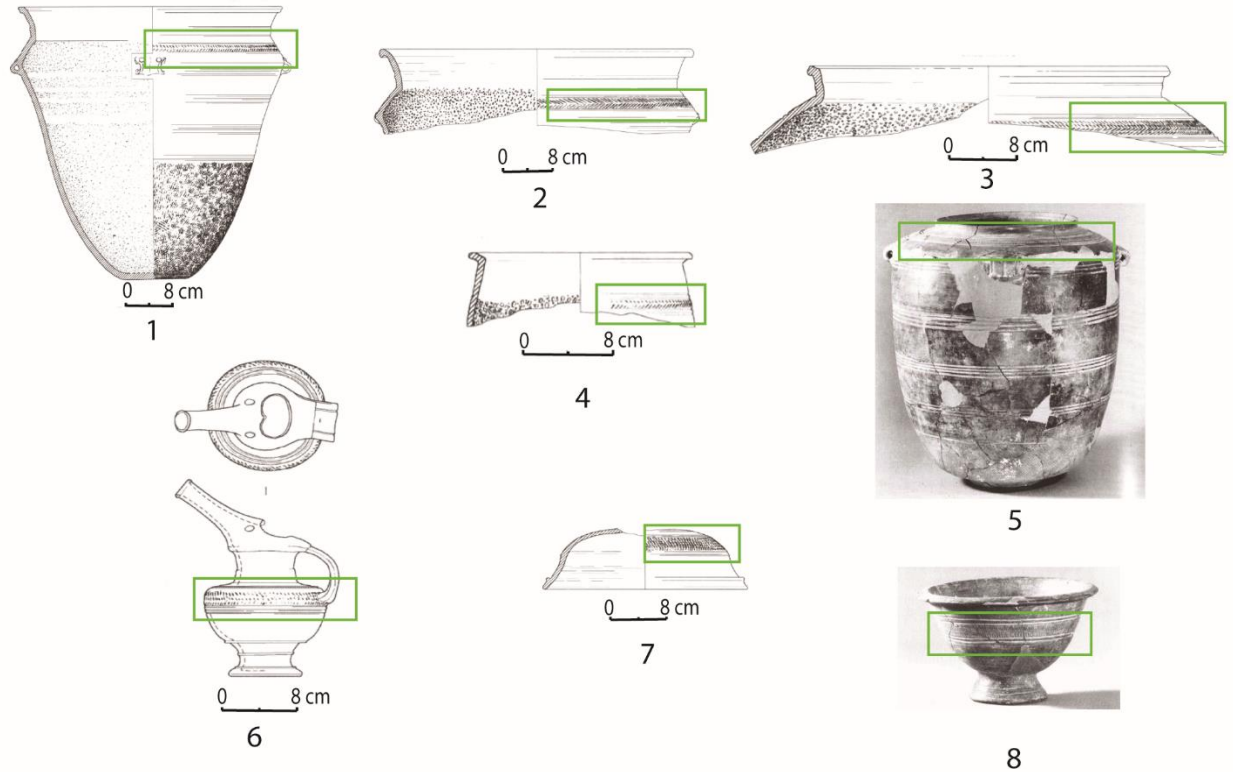


Figure 2.1 Examples of Variable 1 - Fingernail incising (highlighted in the green square)

1. Jar *Zun* 尊 (after *Zhongguo 2014*, pp 245, figure 4-4-1-11-2E: ①10); 2. Jar *zun* 尊 (after *Zhongguo 2014*, pp 272, figure 4-4-1-20-2F: 56); 3. Jar *weng* 瓮 (after *Zhongguo 2014*, pp 276, figure 4-4-1-20-2J: 39); 4. Jar *guan* 罐 (after *Zhongguo 2014*, pp 891, figure 6-4-2-59-2A: 17); 5. Jar *weng* 瓮 (after *Zhongguo 1995*, plate 340); 6. Pitcher *he* 盃 (after *Zhongguo 2014*, pp 791, figure 6-4-2-18-2B: 25); 7. Vessel cover *qigai* 器盖 (after *Zhongguo 2014*, pp 221, figure 4-4-1-4-2A: 22); 8. Pedestal bowl *gui* 簋 (after *Zhongguo 1995*, plate 288)

Variable 2. Incising/stamping in complex patterns

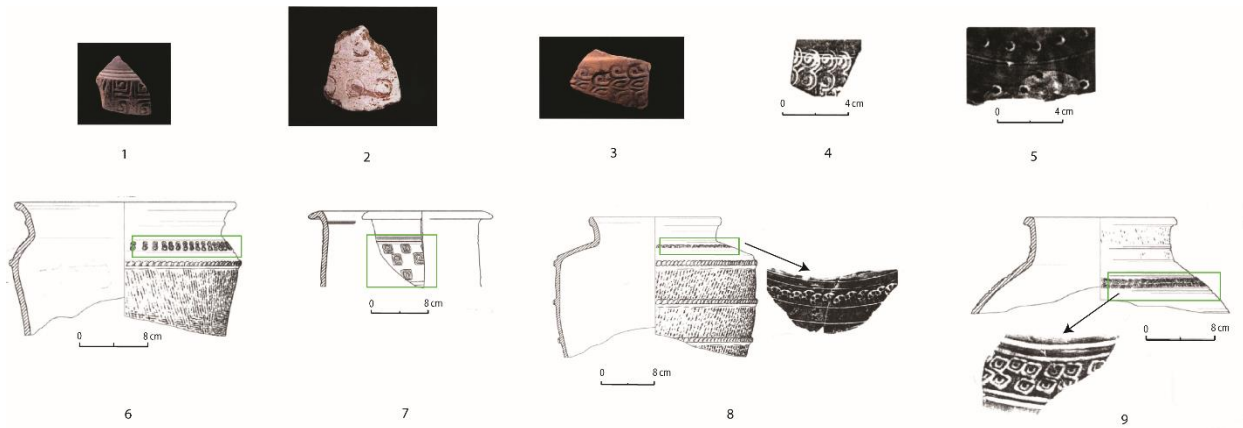


Figure 2.2 Examples of Variable 2 - Incising/stamping in complex patterns (highlighted in the green square)

1. Sherd decorated with incising/stamping in complex patterns *huawen taopian* 花纹陶片 (after *Zhongguo 2014*; colorful plate 254: 7); 2. White pottery in unknown form *tongxing baitaoqi* 筒形白陶器 (after *Zhongguo 2014*, colorful plate 242: 3); 3. Sherd decorated with incising/stamping in complex patterns *huawen taopian* 花纹陶片 (after *Zhongguo 2014*; colorful plate 248: 3); 4. Sherd decorated with incising/stamping in complex patterns *huawen taopian* 花纹陶片 (after *Zhongguo 2014*, pp 392, figure 5-5-1-25-2A: 40); 5. Sherd decorated with incising/stamping in complex patterns *huawen taopian* 花纹陶片 (after *Zhongguo 2014*, pp 392, figure 5-5-1-25-2A: 55); 6. Jar *zun* 尊 (after *Zhongguo 2014*, figure 6-4-2-15-2C: 5); 7. Basin *pen* 盆 (after *Zhongguo 2014*, pp 972, figure 6-4-2-81-2A: 6); 8. Jar *zun* 尊 (after *Zhongguo 2014*, pp 849, figure 6-4-2-46-2: 1); 9. Jar *guan* 罐 (after *Zhongguo 2014*, pp 957, figure 6-4-2-79-2B: 36).

Incising/stamping in complex patterns are mostly deep incising or stamping in complex spiral or other geometric patterns along with a few other varied things. Incising/stamping in complex patterns (*hua wen* 花纹) are highly likely to be seen on storage vessels, most of which are jars. Some sherds with this type of decoration in the collection of 1999 - 2006 have been published under the name of *huawen taopian* 花纹陶片 (*Zhongguo 2014*). Some archaeologists further separate it as stamped decoration, and incised decoration (which also includes fingernail incising in this study, and others in relatively simple patterns). They find the vessels with stamped decoration or incised decoration only taking up 4.1% in Erlitou Phase 1, 4.8% in Erlitou Phase 2

and Phase 3, 4.4% in Erlitou Phase 4 among the pieced together vessels found during 1959 - 1978 excavations (Zhongguo 1999). This decoration pattern is usually applied to the shoulder or upper belly of a vessel's outer surface and in different shapes (Zhongguo 1995 and 1999; Figure 2.2). And it is usually only applied in one or two rows on a vessel, and, thus, it could be much rarer among the piles of sherds. Also, such decoration could be more time-consuming than other others. Thus, based on its intrinsic characteristics, the incising/stamping in complex patterns can be argued to connect highly with either wealth or prestige.

Variable 3. Polishing

The jars, basins, plates, bowls, cups, pitchers, and vessel covers are all possible to be polished, all over or only part of the outer surface. Polishing was more common than fingernail incising (*zhijia wen* 指甲纹) and incising/stamping in complex patterns (*hua wen* 花纹), which are usually seen only on a restricted part (shoulders or upper bellies) of the vessels. Additionally, more than two types of decoration can often be seen on one vessel, even the three types of decorations in discussion. One polished sherd or vessel could be decorated with fingernail incising or incising/stamping in complex patterns (Figure 2.3). Archaeologists find polished vessels taking up 31.8% in Erlitou Phase 1, 31.2% in Erlitou Phase 2, 22.1% in Erlitou Phase 3, and 17.3% in Erlitou Phase 4 among the piecing together vessels found during 1959 - 1978 excavations (Zhongguo 1999). Whereas, polishing increases the exquisiteness of certain vessels. Polished vessels suggest a time- and energy- expenditure during pottery production. Thus, polished vessels/sherds can be argued to connect highly with either wealth or prestige.

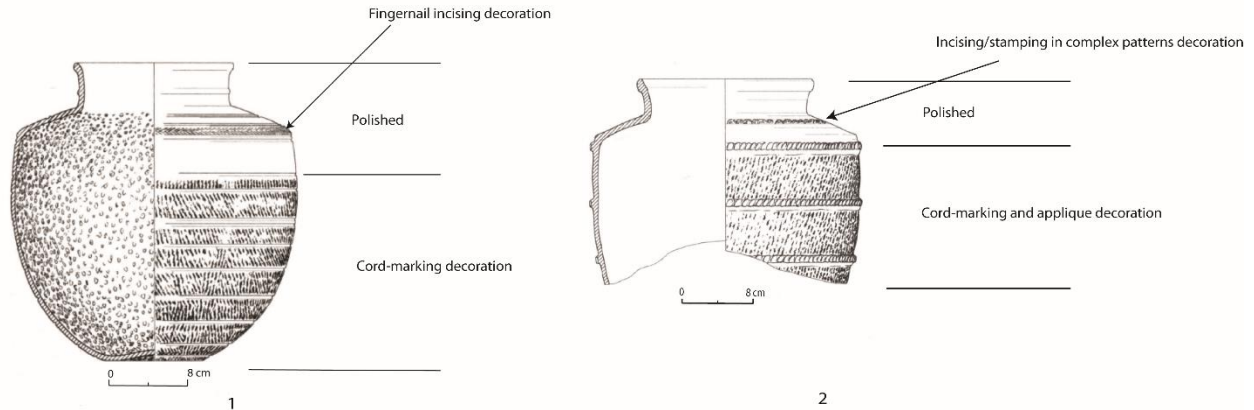


Figure 2.3 Examples of polished vessels with fingernail incising or incising/stamping in complex patterns

1. jar *guan* 罐 (modified from *Zhongguo* 2014, pp 881, figure 6-4-2-56-2E: 62); 2. jar *zun* 尊 (modified *Zhongguo* 2014, pp 849, figure 6-4-2-46-2).

Variable 4. Feasting utensils and vessels

Feasting is an important venue for aggrandizers to compete and maintain their prestige (Clark and Blake 1994; Spielmann 2002). Sharing food requires large consumption of serving and drinking utensils and vessels. As feasting also serves for display of the capacity of competition and power, exquisite serving and drinking vessels will be consumed in large quantities. During the Bronze Age of China, food offerings and communal banquets were important in the political economies, serving as an intricate gift-economy to strengthen the familial bonds and even transcend political rights (Sterckx 2005; Cook 2005).

Feasting utensils and vessels seen in Erlitou include bone utensils, serving vessels, and drinking vessels (Figure 2.4). Bone utensils (*gu bi* 骨匕) probably served like a spoon to put food into mouth (Wang 1990; Wang 2000). Serving vessels include stemmed plates (*dou* 豆), tripod plates (*sanzu pan* 三足盘), pedestal plates (*quanzu pan* 圈足盘), flat-bottomed bowls (*pingdi pen* 平底盆) and pedestal bowls (*gui* 簋). Drinking vessels are cups (*jue* 爵, *gu* 觚 and *Bei* 杯), and pitchers (*he/gui* 盃/鬯).

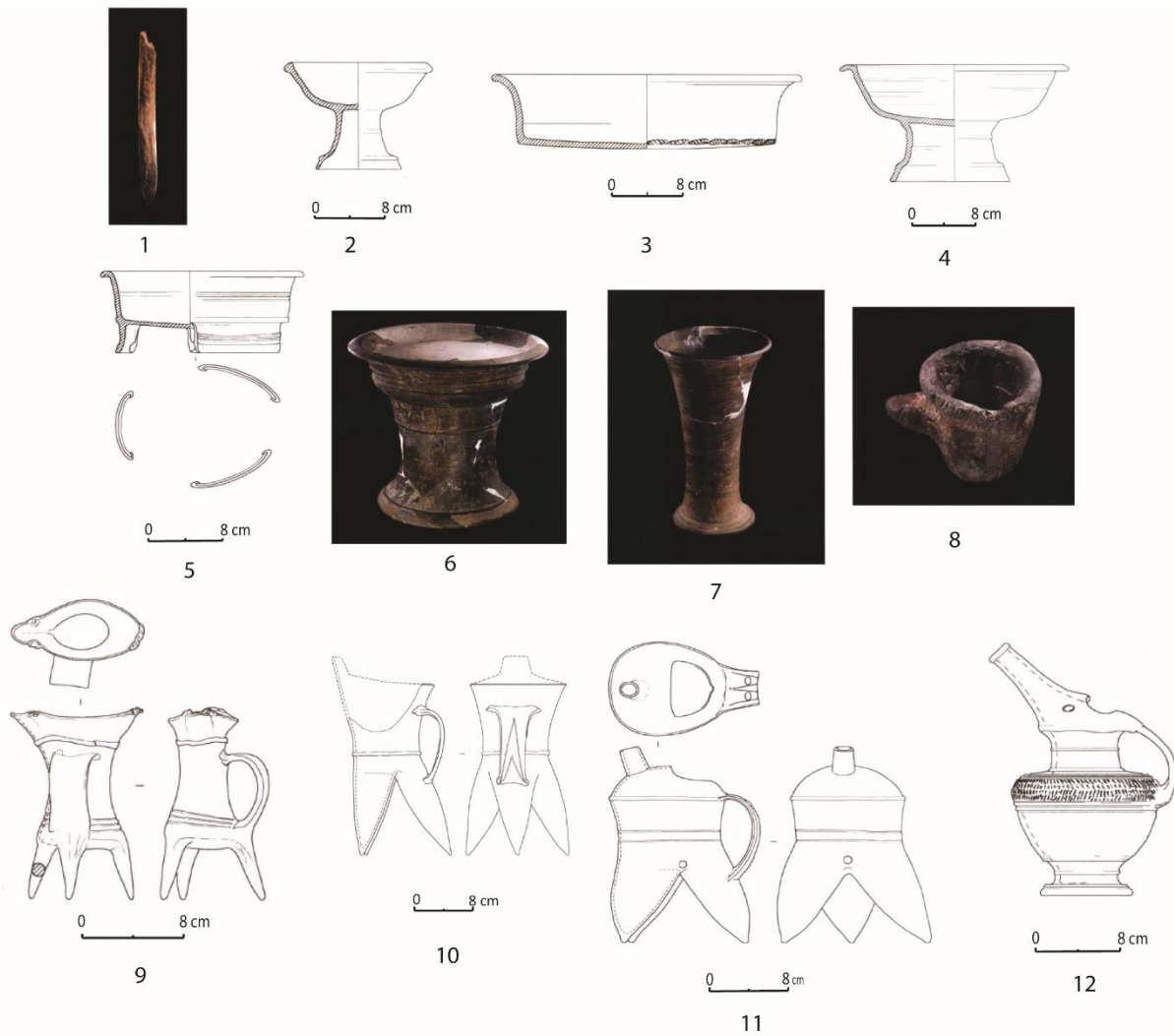


Figure 2.4 Examples of Variable 4 - Feasting utensils and vessels

1. Bone utensil *gu bi* 骨匕 (after *Zhongguo 2014*, colorful plate 343: 7); 2. Plate *dou* 豆 (after *Zhongguo 2014*, pp 79, figure 3-2-1-11: AbIII); 3. Bowl *pingdi pen* 平底盆 (after *Zhongguo 2014*, pp 77, figure 3-2-1-9B: AbIII); 4. Bowl *gui* 簋 (after *Zhongguo 2014*, pp 81, figure 3-2-1-12: A II); 5. Plate *sanzu pan* 三足盘 (after *Zhongguo 2014*, pp 78, figure 3-2-1-10: Ab I); 6. Plate *quanzu pan* 圈足盘 (after *Zhongguo 2014*, colorful plate 236: 3); 7. Cup *gu* 觚 (after *Zhongguo 2014*, colorful plate 231: 1); 8. Cup *bei* 杯 (after *Zhongguo 2014*, colorful plate 232: 6); 9. Cup *jue* 爵 (after *Zhongguo 2014*, pp 107, figure 3-2-1-25: A I); 10. Pitcher *gui* 鬯 (after *Zhongguo 2014*, pp 104, figure 3-2-1-23: A I); 11. Pitcher *he* 盃 (after *Zhongguo 2014*, pp 106, figure 3-2-3-24A: Ab II); 12. Pitcher *he* 盃 (after *Zhongguo 2014*, pp 107, figure 3-2-1-24B: B II).

Drinking vessels and serving vessels were often buried in elite tombs. Some archaeologists believe they indicate prestigious identity and status (Xu 2009 and 2022). Pitchers work as wine heating or pouring vessels, while cups were drinking vessels (Zhongguo 1995; Xu 2009 and 2022). Some pitchers could even be made of kaolin paste, a much finer paste requiring a higher baking temperature, different from the other pottery vessels. Plates, and bowls are believed to be serving vessels and were all made of fine paste (Xu 2009 and 2022; Hu 2020; Liu 2021). Most of them tend to be polished, even some serving vessels would be decorated with finger-nail incising.

Variable 5. Storage vessels

Storage vessels include jars (*Zun* 尊, *weng* 瓮, *guan* 罐, and *hu* 壶), vats (*Gang* 缸) and basins (*Pen/yu* 盆/盂) (Figure 2.5). The Erlitou storage vessels could be used for storing crops, although some have been conjectured as fermenting and storage vessels for beverages (Fang 1995; Zhongguo 2003; Xu 2009 and 2022). No matter what specific purpose they were used for, they should be no doubt as storage vessels. The more storage vessels one household unit consumed, the more crops or beverages can they consume. In this case, it can be argued to connect highly with wealth.

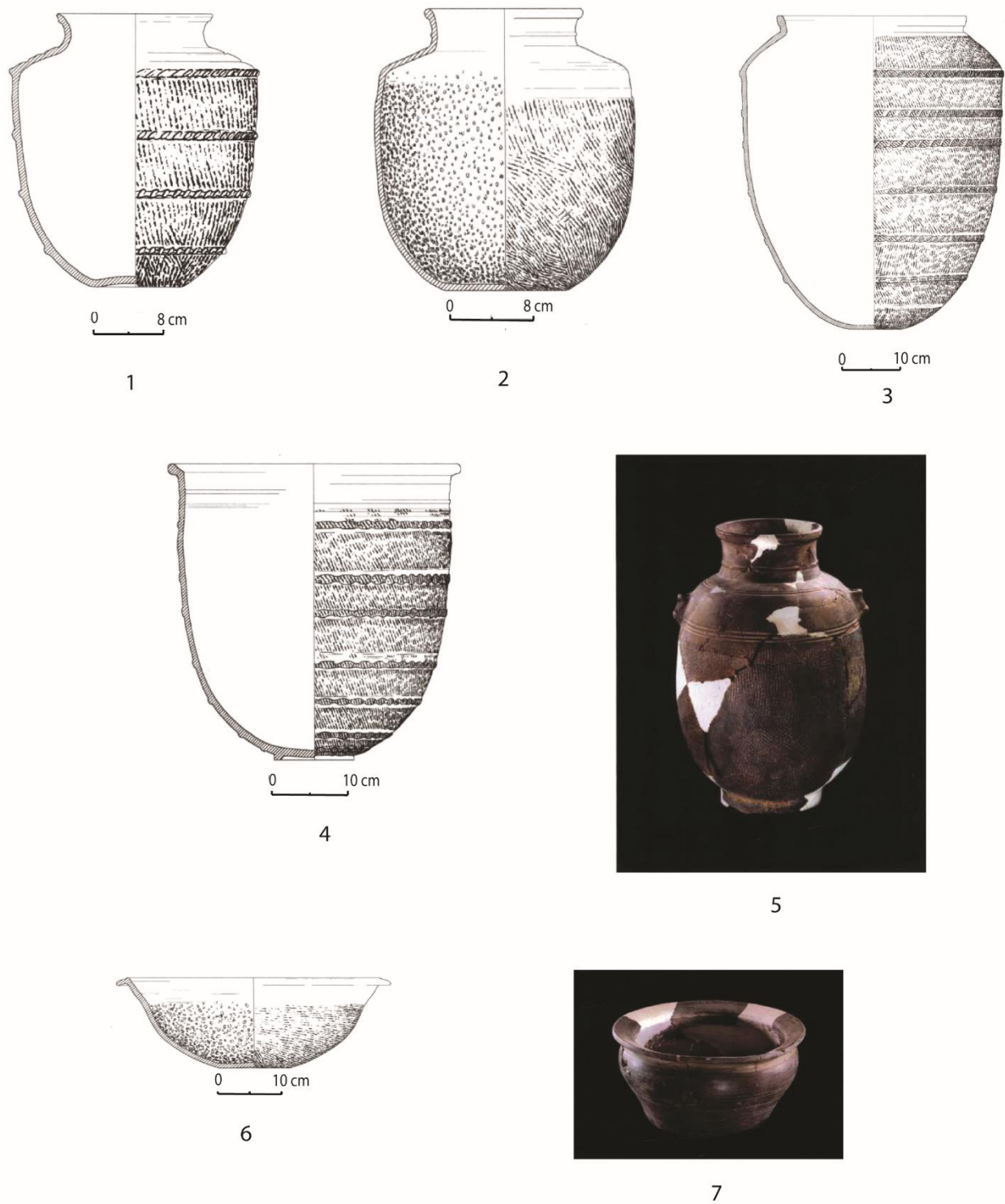


Figure 2.5 Examples of Variable 5 - Storage vessels

1. Jar *zun* 尊 (after *Zhongguo* 2014, pp 89, figure 3-2-1-16B: Bb II); 2. Jar *guan* 罐 (after *Zhongguo* 2014, pp 97, figure 3-2-1-15B: B I); 3. Jar *weng* 瓮 (after *Zhongguo* 2014, pp 97, figure 3-2-1-21D); 4. Vat *gang* 缸

(after *Zhongguo 2014*, pp 99, figure 3-2-1-22A: AIV); 5. Jar *hu* 壺 (after *Zhongguo 2014*, colorful plate 224: 4); 6. Basin *pen* 盆 (after *Zhongguo 2014*, pp 71, figure 3-2-1-7B: Ba V); 7. Basin *yu* 盂 (after *Zhongguo 2014*, colorful plate 235: 2).

Variable 6. Food preparation artifacts

Food preparation artifacts include grater-bottom bowls (*kecao pen* 刻槽盆), and lithic mortars (*jiu* 臼), pestles (*chu* 杵), and round-shaped lithics (*shibing* 石饼) (Figure 2.6). Most of the food preparation artifacts in this household unit sample are pottery grater-bottom basins. Grater-bottom bowls are believed to be a grinding tool, and recent starch grain analyses based on the samples from the Lingjiatan 凌家滩 site, Anhui, and the Diaolongbei 雕龙碑 site, Hubei, reveal that the grater-bottom bowls were used to grind wild Poaceae and Triticeae plants, and other root and tuber plant food collected from the environment (An 1986; Ye 1989; Ding 2007; Tao et al. 2009; Sun et al. 2019). A few others are lithic food preparation artifacts. One household (G2) is only with a lithic pestle, 2 household units (G3 and D4) are only with lithic mortars, and one household (G21) is with a pair of pestle and mortar. This probably means that mortars were not only accompanied by lithic pestles, but also with pestles made of organic materials, like wood. Some archaeologists conjecture that the assemblages of pestles and mortars were used for threshing rice (Song 1997; Xu 2017). It has been argued that the supply and consumption of rice in Erlitou probably relied on tribute import (*Zhongguo 2014*; Zhao and Liu 2019). Round-shaped lithics are another possible lithic food preparation artifact. The pounding scars on them suggest they may be used for cracking nuts. Thus, most of the food processors were likely to process wild collected food.

Millets (*Setaria italica* and *Panicum miliaceum*), and rice (*Oryza sativa*) may form staple food in this site during the Erlitou period, accompanied by some consumption of wheat (*Triticum*

aestivum), and soybeans (*Glycine max*), according to the palaeobotanical study (Zhongguo 2014; Zhao and Liu 2019). Agricultural production, especially the food tribute economy, may have served the most proportion of food consumption in the Erlitou site (Zhongguo 2014). Such food support may liberate the Erlitou people from food production and, even, pre-preparing on their own. There may be some workers or communities specialized in threshing millets or rice, so, although they consumed the millets, they did not have to do threshing on a household basis. But they still needed some food preparation artifacts to consume wild collected food to enlarge their food menu. Certainly, it cannot eliminate the possibility that there were other forms of pestles and mortars. For example, archaeologists found semi-subterranean mortars dating back to Yangshao period (5000 BC – 3000 BC) in the Qingtai 青台 site, Henan, the Dadungzi 大墩子 site, Jiangsu, and the Honghuatao 红花套 site, Sichuan, and wood pestles in Bashidang 八十垱 site (7000 BC – 6000 BC), Hunan, and the Hemudu 河姆渡 site (5000 BC – 4000 BC), Zhejiang (Song 1997; Xu 2017). If so, it may still require a household basis food preparing, but definitely restrain the identification of food preparation artifacts. On the other hand, rice was most consumed by Erlitou elites (Gao and Wu 2022). So, commoners, although they still have some access to rice, may not have the large demand for food preparation artifacts for threshing rice. Therefore, these food preparation artifacts are reasonably to be in the small proportion for each household unit, but the food preparation artifacts should connect with wealth.



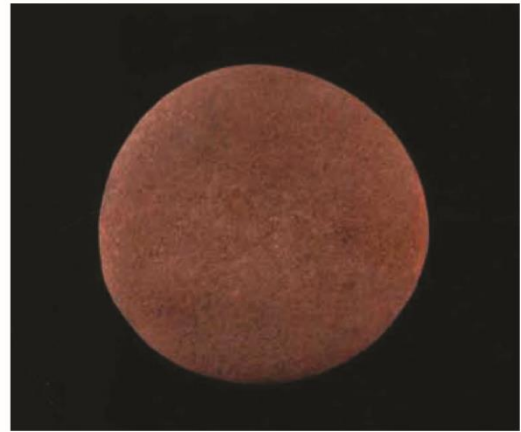
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Figure 2.6 Examples of Variable 6 – Food preparation artifacts

- 1. Grater-bottom bowl *kecao pen* 刻槽盆 (after *Zhongguo 2014*, colorful plate 186: 3); 2. Lithic pestle *chu* 杵 (after *Zhongguo 2014*, colorful plate 316: 7); 3. Lithic mortar *jiu* 臼 (after *Zhongguo 2014*, colorful plate 317: 2); 4. Round lithics *shibing* 石饼 (after *Zhongguo 2014*, colorful plate 323:3).**

Variable 7. Ornaments

Ornaments can be seen in the forms of the bone hairpins (*zan/chai* 簪/钗), bone, shell, and pottery beads (*gu zhu* 骨珠, *bang zhu* 蚌珠, and *tao zhu* 陶珠), pottery circles (*tao huan* 陶环) and

turquoise sheets for inlaying (Figure 2.7). Most of the ornaments seen in the household units are bone hairpins (*zan/chai* 簪/钗). There are also some household units accompanied by beads in bone, shell, and pottery, and pottery circles. Studies on the beads and circles found in other sites reveal that the two ornaments may be worn on the garments and circles may also serve as rings or earrings (Li and Huo 1990; Zhang 2003). These personal ornaments seen in the household units, although non-decorated and seeming to be relatively mundane, not so luxurious as the jade ornaments and turquoise ornaments found in the Erlitou elite burials, can be argued to connect with wealth.

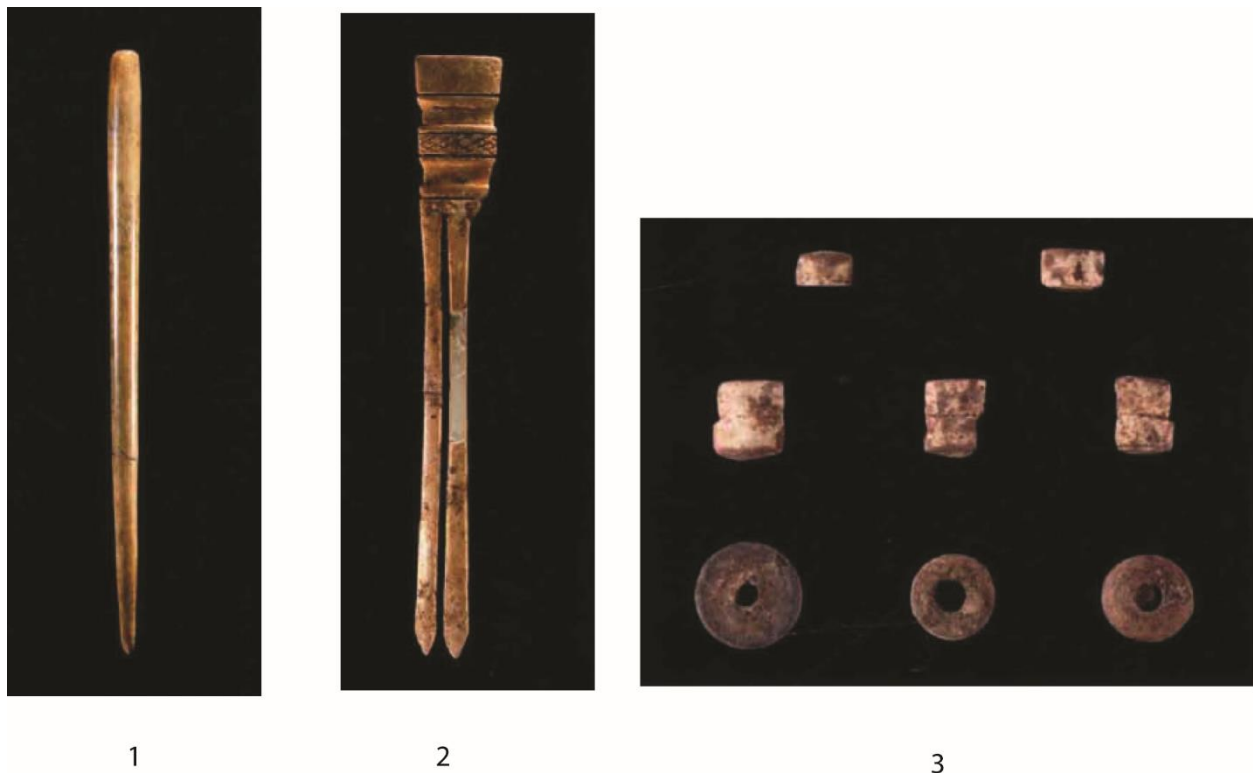


Figure 2.7 Examples of Variable 7 – Ornaments

- 1. Hairpin *zan* 簪 (after *Zhongguo 2014*, colorful plate 353:8);**
- 2. Hairpin *chai* 钗 (after *Zhongguo 2014*, colorful plate 358:2);**
- 3. Bone beads *gu zhu* 骨珠 (after *Zhongguo 2014*, colorful plate 365:2).**

On the other hand, one household (G8) had one turquoise sheet ready for inlay, suggesting it was possibly capable of having a luxury item decorated by turquoise. Luxury goods and ritual

paraphernalia inlaid by turquoise sheets, by far, have only been seen in the Erlitou elite burials (Li, Z. 2008). Qin (2014) points out that the turquoise sheets/pieces were generally inlaid in three ways: 1) on the bronzes (like turquoise-bronze plaques, weapons, and round ritual bronzes), 2) on the organic holders, and 3) on the jades. So, to some extent, the turquoise sheets/pieces for inlay were mainly for decoration, although they may carry ritual meanings and add ritual myths on the bronzes or jades. The Erlitou state has been argued to procure turquoises from multiple sources through long-distance transportation (Xian et al. 2021; Qin 2022). Thus, the exotic ornaments can also be argued to connect to wealth.

Variable 8. Carpentry/construction tools

Carpentry/construction tools include lithic adzes (*beng/zao* 斨/凿), spades (*chan* 铲), and Axes (*fu* 斧), and bone spades (*chan* 铲) and saws (*ju* 锯) (Figure 2.8). Axes have been argued to be for felling trees and chopping woods, spades might be used for digging, and adzes and saws might be for wood processing and carpentry purposes (Yang 1982; Yin 1986; Xie 2008; Xiao 2020). Spades may be argued to be also used in agriculture because of their digging purpose. Because archaeologists have found digging impressions on the walls of some garbage pits matching the attributes of the spades, this study puts the spades in the carpentry/construction tools, although the spades could still be possibly used in agriculture (Zhongguo 1999).



1



2



3

Figure 2.9 Examples of Variable 9 – Agricultural tools

1. Lithic knife *shi dao* 石刀 (*Zhongguo 2014*, colorful plate 292:4); 2. Lithic sickle *shi lian* 石镰 (*Zhongguo 2014*, colorful plate 299:4); 3. Shell sickle *bang lian* 蚌镰 (*Zhongguo 2014*, colorful plate 390:1)

Variable 10. Textile tools

Textile tools include lithic spindle whorls (*shi fanglun* 石纺轮), bone needles (*gu zhen* 骨针) and awls (*gu zhui* 骨锥), shell awls (*bang zhui* 蚌锥), and pottery spindle whorls (*tao fanglun* 陶纺轮) (Figure 2.10). Spindle whorls might be for spinning, needles might be for sewing, and awls might be for weaving or cloth/leather working.

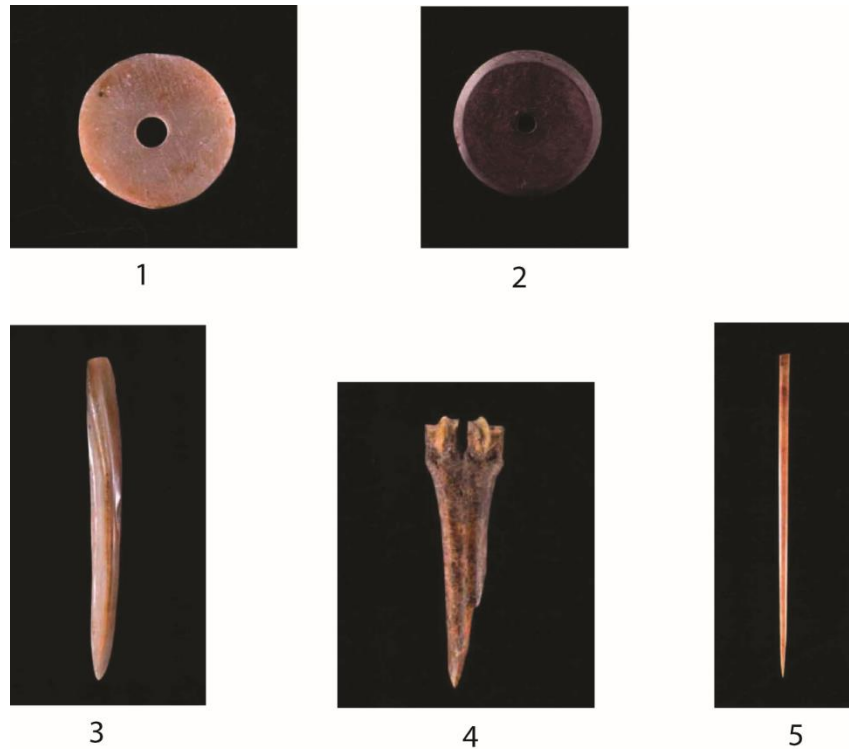


Figure 2.10 Examples of Variable 10 – Textile tools

1. lithic spindle whorls *shi fanglun* 石纺轮 (after *Zhongguo 2014*, colorful plate 315:3); 2. Pottery spindle whorls *tao fanglun* 陶纺轮 (after *Zhongguo 2014*, colorful plate 262:5); 3. Shell awl *bang zhui* 蚌锥 (after *Zhongguo 2014*, colorful plate 391:4); 4. Bone awl *gu zhui* 骨锥 (after *Zhongguo 2014*, colorful plate 348:5); 5.

Bone needle *gu zhen* 骨针 (after *Zhongguo 2014*, colorful plate 358:7)

Variable 11. Weapons/hunting tools

Weapons/hunting tools include lithic axes (*shi yue* 石钺), and arrowheads (*shi zu* 石镞), bone arrowheads (*gu zu* 骨镞), antler arrowheads (*jiao zu* 角镞), shell arrowheads (*bang zu* 蚌镞) and bronze arrowheads (*tong zu* 铜镞) (Figure 2.11).

The weapons/hunting tools found in the 1959 - 1978 suggest that the weapons/hunting tools experienced an increase during the Erlitou period, possibly because of the military expansion, motivated by the procurement of natural resources, and the challenge from the Erligang polity (Liu and Chen 2003; *Zhongguo* 1999; Liu 2006). Recently, archaeologists have found that wild animals

were consumed not more than 25% while domesticated animal took up more than 80% in the total identifiable mammal bone remains throughout the Erlitou period and the Erligang period (Zhongguo 2014). Such proportion probably suggests that the ancient people in the Erlitou site emphasized the domesticated animals instead of the wild animals for meat acquiring, although hunting might still serve for some food supply. Thus, the weapons/hunting tools seen in the household context are more likely to be weapons than hunting tools although the arrowheads still could serve in hunting to some extent, and the commoners could keep their weapons in their houses.



Figure 2.11 Examples of Variable 11 – Weapon/hunting tools

1. Lithic axes *yue* 钺 (after *Zhongguo 2014*, colorful 325:1);
2. Lithic arrowhead *shi zu* 石镞 (after *Zhongguo 2014*, colorful plate 328:4);
3. Shell arrowhead *bang zu* 蚌镞 (after *Zhongguo 2014*, colorful plate 392:6);
4. Bone arrowhead *gu zu* 骨镞 (after *Zhongguo 2014*, colorful plate 363:8);
5. Bronze arrowhead *tong zu* 铜镞 (after *Zhongguo 2014*, colorful plate 283:4).

Variable 12. Resharpener tools

The resharpener tools in this study refer to whetstones (*lishi* 砺石) (Figure 2.12). Most of the whetstones in this study are those collected and published under the name of “whetstone (*lishi* 砺石)” in the archaeological report (Zhongguo 2014), and such type has been argued to serve in lithic, bone, antler, shell, jade or turquoise item/tool processing, especially for sharpening or

resharpening other practical tools with blades. This variable also includes 4 lithic saws (*shiju* 石锯), under the category of “whetstone”, which could be also used in the item/tool processing in conjunction with other whetstones, slicing the rocks, turquoises, or jades for further processing, and, sometimes, sharpening or resharpening items immediately by them.



1



2

Figure 2.12 Examples of Variable 12 – Resharpening tools

1. Whetstone *lishi* 砺石 (after *Zhongguo* 2014, colorful plate 320:7);
2. Whetstone *lishi* 砺石 (after *Zhongguo* 2014; colorful plate 331:3).

In addition, there is another one whetstone collected and published under the name of “lithic rotary grinder (*shizhoucheng* 石轴承)”. A series of papers have debated about the usage of one type of whetstone or so-called lithic rotary grinders found throughout China. Several archaeologists argue that some whetstones which can be called rotary grinders were used on a wheel machine as a gear or motion-transmitter helping a drill tool to drill jades or lithics (Xu, Tang and Ye 2018). Some archaeologists (Li 2019) argue that such called rotary grinders should still be whetstone and they were used immediately to drill or to smooth the drilling instead of a rotary device in an instrument. No matter how such type of whetstone was used, the only one whetstone or so-called lithic rotary grinder seen in the Erlitou household context should also be used in item/tool processing. Therefore, resharpening tools in this study should be used in item/tool

processing, mostly for sharpening or resharpening, although only a few may also be used for slicing and/or drilling.

Variable 13. Fishing tools

Fishing tools are bone darts (*gu biao* 骨镖) and pottery net sinkers (*tao wangzhui* 陶网坠) (Figure 2.13). The two forms of fishing tools are related to the fishing activities for collecting subsistence.

Compared to agriculture and husbandry, fish were never over 1% among the identifiable animal remains throughout the Erlitou period and the Erligang period (Zhongguo 2014). This proportion suggests probably fish were not heavily consumed by the people in the Erlitou site and probably the people in the Erlitou site did not emphasize fish for subsistence.

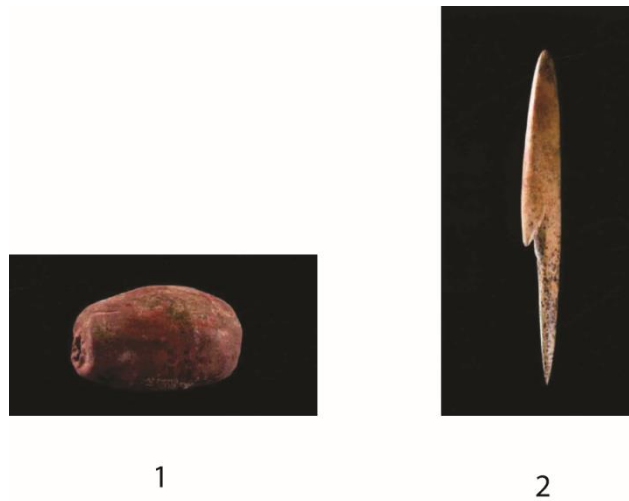


Figure 2.13 Examples of Variable 13 – Fishing tools

1. Pottery net sinker *tao wangzhui* 陶网坠 (after *Zhongguo 2014*, colorful plate 263:2);
2. Bone dart *gu biao* 骨镖 (after *Zhongguo 2014*, colorful plate 347:2)

Variable 14. Ritual paraphernalia

Most of the ritual paraphernalia in this study are the oracle bones (*bu gu* 卜骨) (Figure 2.14). Divination is one religious activity seen at Erlitou. Scapulimancy can be seen in the garbage

pits, ash ditches, earthen layers, enclosing walls of the palatial enclosure and the footings or walls of buildings. Some archaeologists believe that, in the early phase of state formation in China, elites monopolized the communication between ancestors and deities, and other people relied on the help of the shaman elites if they wanted to contact with ancestors and deities (Chang 1989). Based on the 160 oracle scapulars found during 1999 - 2006, Chen and Li (2013) find that the bovid scapula are the most, taking up about 50%, pig and sheep/goat scapula comes next, and only about 6.25% are deer scapula. Since most cattle, pig, and sheep/goat have been identified as domesticated (Zhongguo 2014), the Erlitou pyromancy probably consumed mainly domesticated animal. Although most scapulimancy were not with preparation like drilling hollows on the scapula and leveling rear surface by cutting off the spine, pre-prepared scapulimancy starting from the Erlitou Phase 3 probably suggests that the diviners began to influence the readings (Chen and Li 2013). Chen and Li (2013), based on their findings, propose that there could be professionalized diviners at Erlitou.

There is another one pottery ritual paraphernalia, hollow-bottomed vessel (*toudiqi* 透底器), found in one household unit. This pottery artifact, aligned with other three seen in the collection before 1999 - 2006 and a few seen in other sites from the Early Bronze China, has no bottom (Du 2006; Wang 2019). The absence of bottom indicates this type of pottery artifacts were not for containing, storing, or other daily practical purposes. Some archaeologists argue that such pottery artifacts should serve as a ritual paraphernalia (Du 2006; Wang 2019). Thus, the more ritual paraphernalia seen in a household unit may probably suggest household units were more involved in or specialized in ritual worshipping, and probably in a higher or more respectable social status.



Figure 2.14 Example of Variable 14 – Ritual paraphernalia

Oracle bone *bu gu* 卜骨 (after *Zhongguo 2014*, colorful plate 402:2).

Variable 15. Lithic production

Most of the lithic production data were collected and published under the name of lithic raw materials (石料), and some were collected and published under the name of broken lithic artifact (石器残件) (Figure 2.15). According to Anne Ford (2004), the reduction strategy of spades, axes, chisels, adzes, and knives could be flaking, hammer dressing and grinding, and finished. This study combines the two stages, flaking, and hammer dressing and grinding together as blank, and tries to categorize the lithic raw materials into unworked stone, core, flake, blank, and indeterminate. This study also finds some broken lithic artifacts are lithic blanks. This variable only counts lithic cores, flakes, and blanks. The lithic production data seen in the household units' sample probably indicate certain families' involvement in lithic production.

Sandstone (36.5%), andesite (22.75%), limestone (7.3%), and some other types of rocks were widely consumed in the Erlitou site (Qian et al. 2014). Except the andesite could be obtained from the riverbed of the Old Luo River (古洛河) at the south of the Erlitou site, limestone, sandstone, dolomite, and some other types of rocks could only be procured from the northern and eastern piedmonts of Mount Song (嵩山) to the south and east of the Erlitou site (Qian et al. 2014; Zhongguo and Zhongaomei. 2019). Huizui 灰咀 is located between the Erlitou site and the northern piedmont of Mount Song, and Shaochai 稍柴 is located between the Erlitou site and the eastern piedmont of Mount Song. They both probably served as nodes for the Erlitou state in procurement and transportation of rock materials, and Huizui might also be a specialized lithic workshop exporting extra lithic goods especially the supply of lithic spades for the Erlitou site because the same rock type and the same reduction technology seen on the lithic spades in the Erlitou site and the Huizui site (Chen et al. 2003; Ford 2004; Chen, X. 2006; Zhongguo 2010; Liu and Chen 2012).

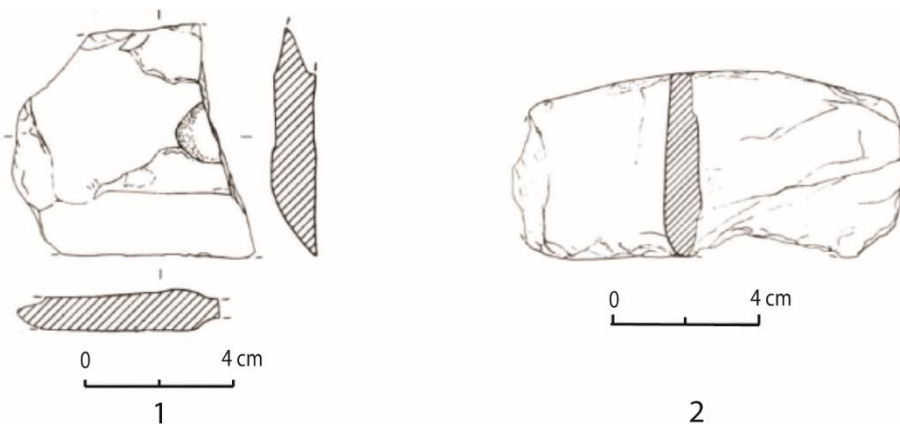


Figure 2.15 Examples of Variable 15 – Lithic production

1. Blank – lithic knife *shidao pijian* 石刀坯件 (after *Zhongguo 2014*, pp 461, figure f5-5-1-38-2: 2);
2. Blank – lithic sickle (handle) *shilianbing pijian* 石镰(柄)坯件 (after *Zhongguo 2014*, pp 456, figure f5-5-1-32-2:1)

Variable 16. Bone production

The bone production data were collected and published under the name of bone raw materials (骨料) (Figure 2.16). According to the processing marks, bone raw materials and artifacts can be categorized into core, blank, waste, semi-finished and finished (Xu, Zhou and Yi 2021; Wang 2018). This study combines blank and semi-finished as one stage called blank, and only focuses on core, blank, and waste. Bone core means those diaphysis without joints. Blank means those showing some processing signs including cutting/sawing and cleaning the cancellous bone. Bone waste includes the cut-off joints and debris. If bone raw materials (骨料) cannot be decided whether they were from bone-tool/item production, such items will be counted as indeterminate ones. This variable only counts bone cores, blanks, and wastes. The bone production data seen in the household units' sample probably indicate certain families' involvement in bone production.



Figure 2.16 Examples of Variable 16 – Bone production

Bone raw materials gu liao 骨料 (after *Zhongguo* 2014, colorful plate 380:1)

Variable 17. Antler production



Figure 2.17 Examples of Variable 17 – Antler production

Antler raw materials *jiao liao* 角料 (after *Zhongguo 2014*, colorful plate 380:2)

The antler production data were collected and published under the name of antler raw materials (角料) (Figure 2.17). According to the processing marks, antler raw materials and artifacts can be categorized into core, blank, waste, semi-finished and finished (Wang 2018; Yu 2016). This study combines blank and semi-finished as one stage called blank, and only focuses on core, blank, and waste. Antler core means those antler beams without the coronet. Antler blank means those showing some processing signs including cutting/sawing and cleaning the cancellous bone. Antler waste means the cut-off coronet and other debris. If the antler raw materials (角料) cannot be decided whether from antler-tool/item production, such items will be counted as indeterminate ones. This variable only counts antler cores, blanks, and wastes. The antler

production data seen in the household units' sample probably indicate certain families' involvement in antler production.

Variable 18. Shell production

The shell production data were collected and published under name of shell raw materials (蚌料). They are hard to decide what stage they were from so that the shell raw materials in this project are called blanks or wastes, all showing the processing signs like grinding or cutting. The shell production data seen in the household units' sample probably indicate certain families' involvement in shell production. As these shell raw materials are the shell of the river mussels, they should be for practical-tool production, shell knives, sickles, arrowheads, or other practical tools.

River mussels (unionidae) were not an important food ingredient for the people in the Erlitou site, and people in the Erlitou site probably did not focus on the consumption of river mussels for food acquiring; unionidae only take up about less than 4% of the total identifiable aquatic invertebrate animal (viviparidae, unionidae and veneridae) (Zhongguo 2014). However, in prehistoric China, the shell tools were particularly made of the shells from Lamellibranchia (Lv and Fu 2010; Hu 2018). Small amount of food consumption of river mussels in the Erlitou site could also lead to an unstable or small amount of raw material supply for the shell artifact/tool production.

Variable 19. Bronze working

Bronze smelting and casting was an important industry at Erlitou. After 55 years of excavation, there have been found one specialized bronze-casting workshop and multiple bronze-melting spots (Zhongguo 1999 and 2003; Chen 2016). Some archaeologists argue that the expansion of the Erlitou polity was partly motivated by the requirement and procurement of copper

resources (Liu and Chen 2003 and 2012). The bronze artifacts can be seen at Erlitou including ritual paraphernalia and prestige goods (Zhongguo 2003). Copper raw materials found in the household units possibly indicate the certain families' involvement in bronze working. Copper raw materials seen in the household units' sample are ores and slag (Figure 2.19).



Figure 2.18 Examples of Variable 19 – Bronze working

1. Slags *tong zha* 铜渣 (after *Zhongguo 2014*, colorful plate 287:1);
2. Ore *tong kuangshi* 铜矿石 (after *Zhongguo 2014*, colorful plate 287:4).

2.3 General patterns of the Erlitou households in the Multidimensional scaling

In order to use multidimensional scaling to measure the patterning among the household units' sample, similarity scores among all cases based on the variables are calculated by a method suitable to the nature of the variables. If all variables are true measurements, Euclidean distance is the most commonly used to measure the dissimilarity of the cases. Simple matching and Jaccard's coefficients are applied for a variable set only including presence/absence variables. Gower's and Anderberg's coefficients would be a best way for a mixed variable set, which includes true measurements, presence/absence variables, categorical variables, and/or ordinal variables. This

study chooses non-standardized Euclidean distance to measure the similarity scores among the household units' sample because all 19 variables are true measurements (ratios).

One important factor for multidimensional scaling is to decide the best possible configuration. The similarity scores could produce multiple sets of configurations in different numbers of dimensions. Reading the different rank order correlations which are referred to be stress values is a good way to find the best set of configurations. Although the different stress values do not produce very different configurations, the lower stress values always indicate the better rank order correlation between the similarity scores. However, the lower stress values or the configurations in increasing dimensions does not always make further improvement for the visualization of the relations between the cases. One useful rule of thumb is that a stress value of about or less than 0.15 is often associated with the most interpretable configurations (Drennan 2010).

The stress values of the dissimilarity scores of the 34 household units with the 19 variables are listed in Table 2.3. The stress value of two-dimensional configuration is 0.037, far less than 0.15, forming a beautiful, clear "elbow" at two dimensions (Figure 2.19). After the stress value of two-dimensional configuration, the stress value, although still declining in the three-dimensional configuration, does not decline much more in configurations of higher dimensionality. The stress value of four and five dimensions, however, begins to climb back up due to the impact of random noise on the iterative procedure. Such a case reveals that the configurations of three and more than three dimensions won't offer a better plot and contribute to a better pattern than the configuration of two dimensions. Thus, this study chooses to look at the two-dimensional scaling of the Erlitou households.

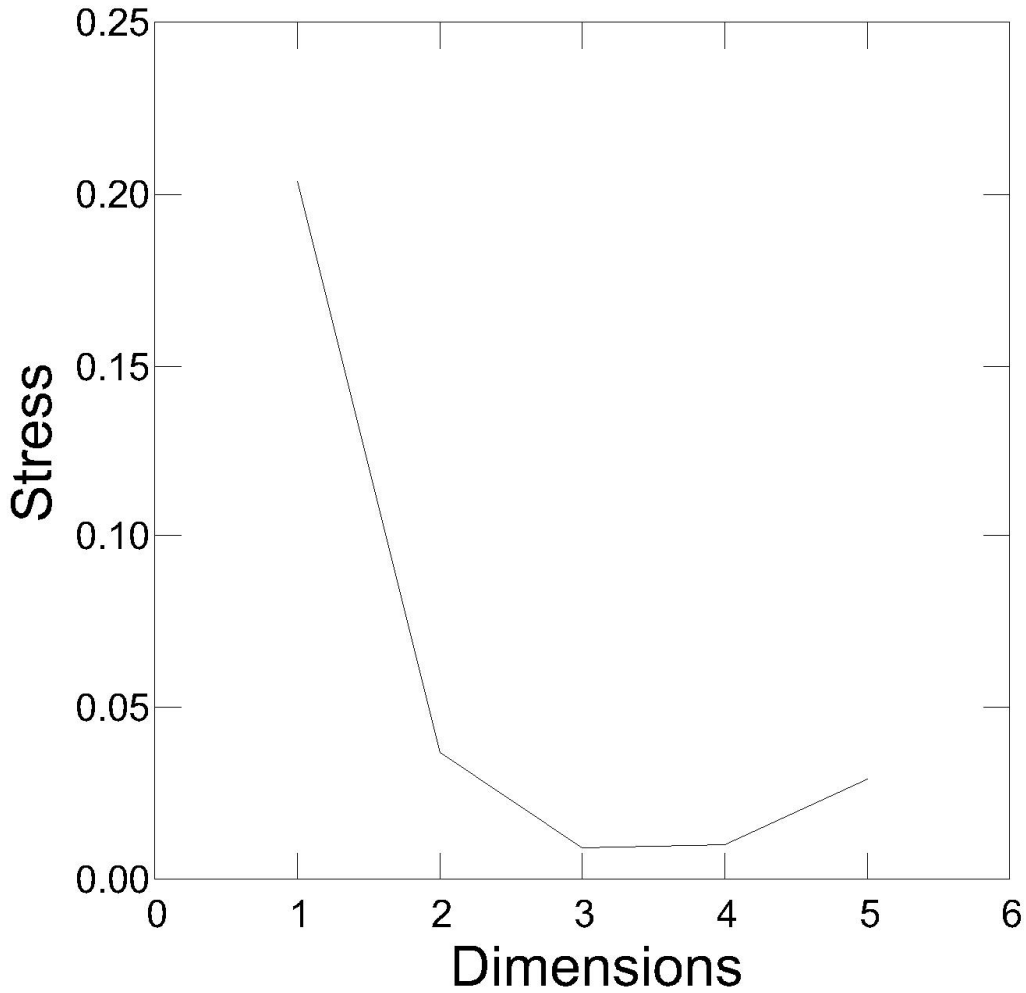


Figure 2.19 Graph of final stress values for analysis of Erlitou household units sample with increasing number of dimensions

Figure 2.20 shows how the 34 household units in this sample are distributed in this two-dimensional scaling plot. Each square represents an artifact assemblage correlating to the 19 variables of one household unit. As the plot shows, there is a cluster in the right center and such cluster includes most of the household units, representing a group of household units generally pretty similar in several dimensions. To the contrast, there is a smaller number of household units standing farther away in several directions from this cluster in which the household units are fundamentally similar. They are standing out by their unusual household assemblages probably

indicating their unusualness in the social dimensions compared to most of the household units. This study will touch on and discuss their unusualness in the following chapters.

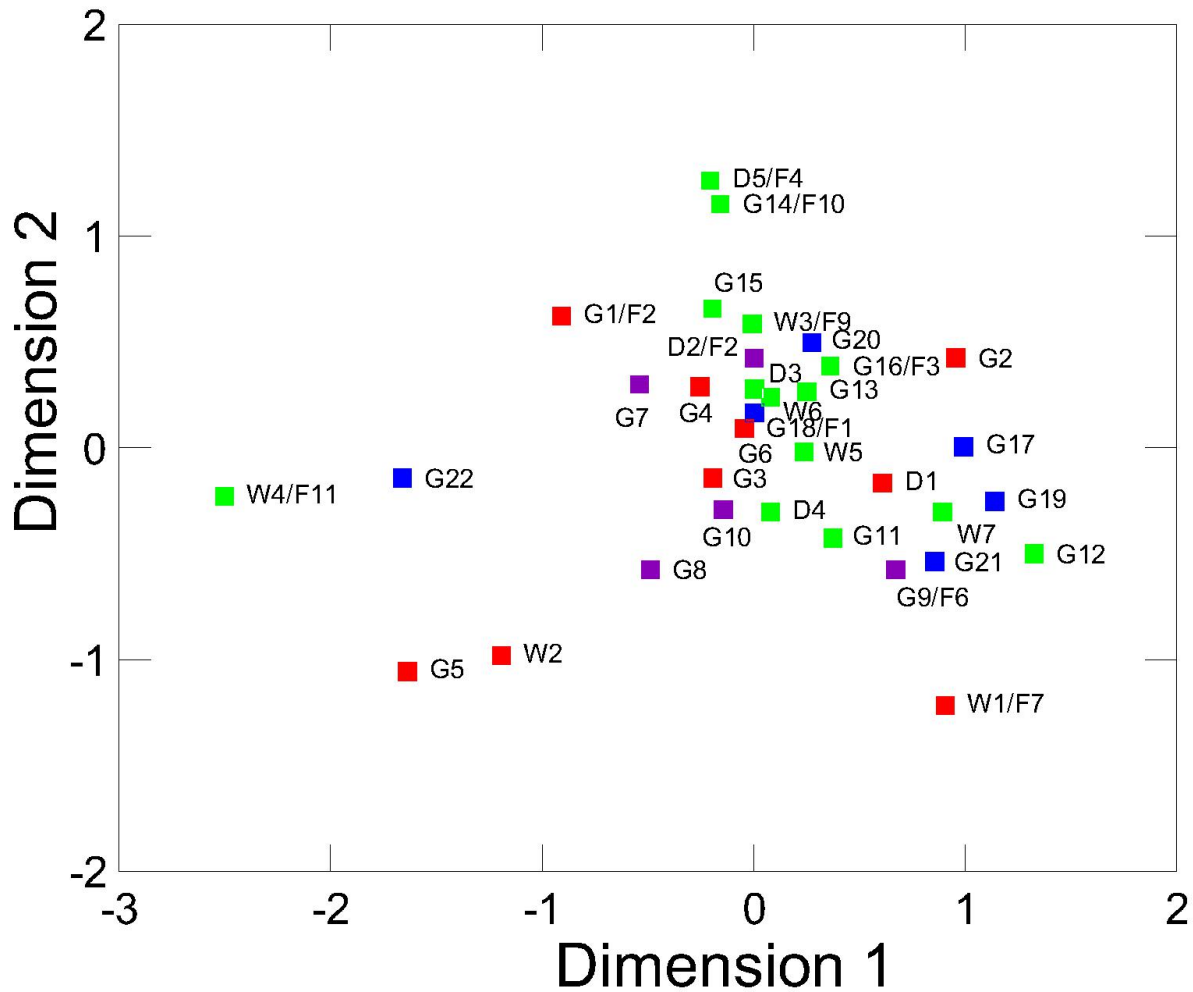


Figure 2.20 Two-dimensional configuration of the 34 household units

(Household units from Erlitou Phase 2 in red, from Erlitou Phase 3 in purple, from Erlitou Phase 4 in green, and from Erligang phase in blue)

Figure 2.20 also displays household units from four phases in different colors in hoping for find whether their differences were because of fashion change through time going; Household units from Erlitou Phase 2 are in red, household units from Erlitou Phase 3 are in purple, household units from Erlitou Phase 4 are in green, and household units from Erligang phase are in blue (Figure 2.2). In this plot, the household units from different phases are all thoroughly mixed together, with

no tendency to separate into sections by phases. Such pattern suggests that the household assemblages of one phase are not more similar to each other than they are to the assemblages of another phase; in other words, the household assemblages did not experience huge change by phases. So, the patterning to be found in the configuration based on the household assemblages seems likely not to change very much during the span of Erlitou's occupation. Thus, it is legitimate for us to interpret patterns in the configuration as related to the various kinds of differentiation rather than to change through time. A set of characteristics in this variable set shown by the two-dimensional scaling configuration may show us differentiation of wealth, prestige, ritual, and production among the Erlitou households.

Table 2.2 The data of the 34 household units under the 19 variables

Household unit	N sherds	N sherds of identifiable vessel forms	Finger-snail incising	Incising/stamping in complex patterns	Polishing	Storage vessels	Feasting utensils & vessels	Food preparation artifacts	Ornaments	Construction/carpentry tools	Agricultural tools	Textile tools	Weapon/hunting tools	Resharpenting tools	Fishing tools	Ritual paraphernalia	Lithic production	Bone production	Antler production	Shell production	Bronze working
G1/F2	243	164	0	0	38	89	12	0	1	2	1	1	1	0	0	0	2	1	2	0	0
G2	845	601	0	0	28	234	30	8	0	0	1	0	0	1	1	3	0	1	0	0	0
G3	132 4	106 3	6	1	221	463	54	7	0	0	0	0	0	0	0	2	0	0	1	0	0
G4	420	317	1	1	57	150	18	2	1	0	0	0	0	0	0	0	0	0	0	0	0
G5	191 0	149 8	29	4	648	703	12 4	12	2	1	1	0	1	1	0	3	0	0	1	3	0
G6	218	150	3	0	29	66	7	4	0	1	1	1	0	0	0	1	0	0	0	0	0
G7	123 6	927	6	2	197	462	49	7	1	0	2	1	1	0	0	1	1	1	2	0	1
G8	294 7	226 4	10	2	630	956	19 1	18	1	0	1	0	0	1	0	1	0	2	0	1	0
G9/F6	617	491	0	0	80	165	28	5	0	0	0	0	0	0	0	0	1	0	0	1	0
G10	174 8	133 1	6	1	303	558	67	29	0	1	0	0	0	1	0	1	0	0	0	0	0
W1/F7	163 2	123 9	12	1	267	336	45	4	2	0	1	2	0	4	0	1	1	3	0	1	0
W2	113 6	945	0	0	340	422	69	3	0	0	3	0	0	1	0	0	0	0	1	1	0
D1	936	805	8	2	92	304	82	4	2	1	0	3	0	2	1	0	2	0	0	0	0
D2/F2	437	337	3	1	48	156	8	0	3	0	2	1	1	1	0	0	0	0	0	0	0
G11	252	182	0	1	35	67	10	1	0	0	0	0	2	1	0	0	0	0	0	0	0
G12	108 2	877	1	0	89	259	13	3	0	1	0	1	1	0	1	0	0	4	0	0	0
G13	358 1	253 8	29	1	356	108 7	81	5	5	4	3	2	8	1	0	3	1	15	2	1	6
G14/F10	76	34	0	0	5	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G15	268 6	204 8	9	2	268	100 5	13 6	50	9	1	1	0	1	0	0	3	3	5	0	1	0
G16/F3	544	344	5	0	44	149	19	1	0	0	1	0	3	1	0	0	0	0	0	0	0
W3/F9	179 5	102 2	5	2	173	487	35	10	2	3	0	0	2	1	0	0	1	0	0	0	0
W4/F11	103	52	1	0	35	31	3	1	0	0	0	0	0	0	1	0	0	0	0	0	0
W5	858 2	691 7	49	9	108 7	283 6	15 4	41	5	6	11	8	7	27	1	9	4	17	0	2	2
W6	100 1	807	7	0	117	357	26	4	0	2	1	0	0	0	0	1	0	2	0	0	0
W7	394	336	3	0	37	114	14	1	1	0	1	0	0	0	0	0	0	2	0	0	0
D3	212 8	169 8	10	1	259	766	42	26	2	2	4	6	2	4	1	0	8	0	0	0	0

D4	271 1	227 6	16	4	418	910	13 1	14	1	4	2	0	0	6	0	1	5	4	0	0	0
D5/F4	199	65	0	2	11	35	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0
G17	186 9	154 5	6	5	122	550	42	6	1	2	4	4	1	1	3	1	1	1	0	0	0
G18/F 1	161 6	998	12	1	204	441	47	8	4	1	3	0	4	0	0	3	0	1	0	0	0
G19	375 0	282 0	9	5	264	913	11 5	14	7	4	7	5	4	2	0	1	2	2	0	0	0
G20	143 7	106 2	6	2	116	475	34	12	0	1	1	0	0	0	0	0	0	0	1	0	0
G21	153 6	114 8	3	0	173	372	65	9	0	2	1	2	0	1	1	1	0	0	2	1	0
G22	165 4	112 9	31	0	413	599	17 3	2	0	1	1	0	1	0	0	1	0	0	0	0	0

Table 2.3 Final stress values for analysis of Erlitou household units sample with increasing number of dimensions

	Stress value
1 dimension	0.204
2 dimensions	0.037
3 dimensions	0.009
4 dimensions	0.010
5 dimensions	0.029

3.0 Wealth differentiation within the Erlitou household sample

3.1 Patterns of the variables correlated to wealth in the two-dimensional configuration

In this chapter, we will explore the patterning of household assemblage variables related to wealth differentiation in the two-dimensional multidimensional scaling configuration presented in Chapter 2. Such variables include *Variable 2 – Incising/stamping in complex patterns*, *Variable 5 – Storage vessels*, *Variable 6 – Food preparation artifacts*, and *Variable 7 – Ornaments*.

3.1.1 Variable 5 – Storage vessels

Figure 3.1 is the two-dimensional configuration plot of the 34 household units in this sample showing values of Variable 5 – storage vessels. Each square in this figure represents a ratio of the number of sherds of storage vessels divided by the number of sherds of identifiable vessel forms in each household unit. Larger squares represent a household unit with a larger proportion of the sherds of storage vessels, indicating a larger amount of storage vessels. In this plot, all household units in this sample have some storage vessels, in a proportion ranging from about 30% to around 60% (Table 3.1). This range is substantial, varying from quite a small amount of the identifiable vessels to a clear majority. Such variation could indicate some large differences in the amount of stored goods, or wealth, in other words.

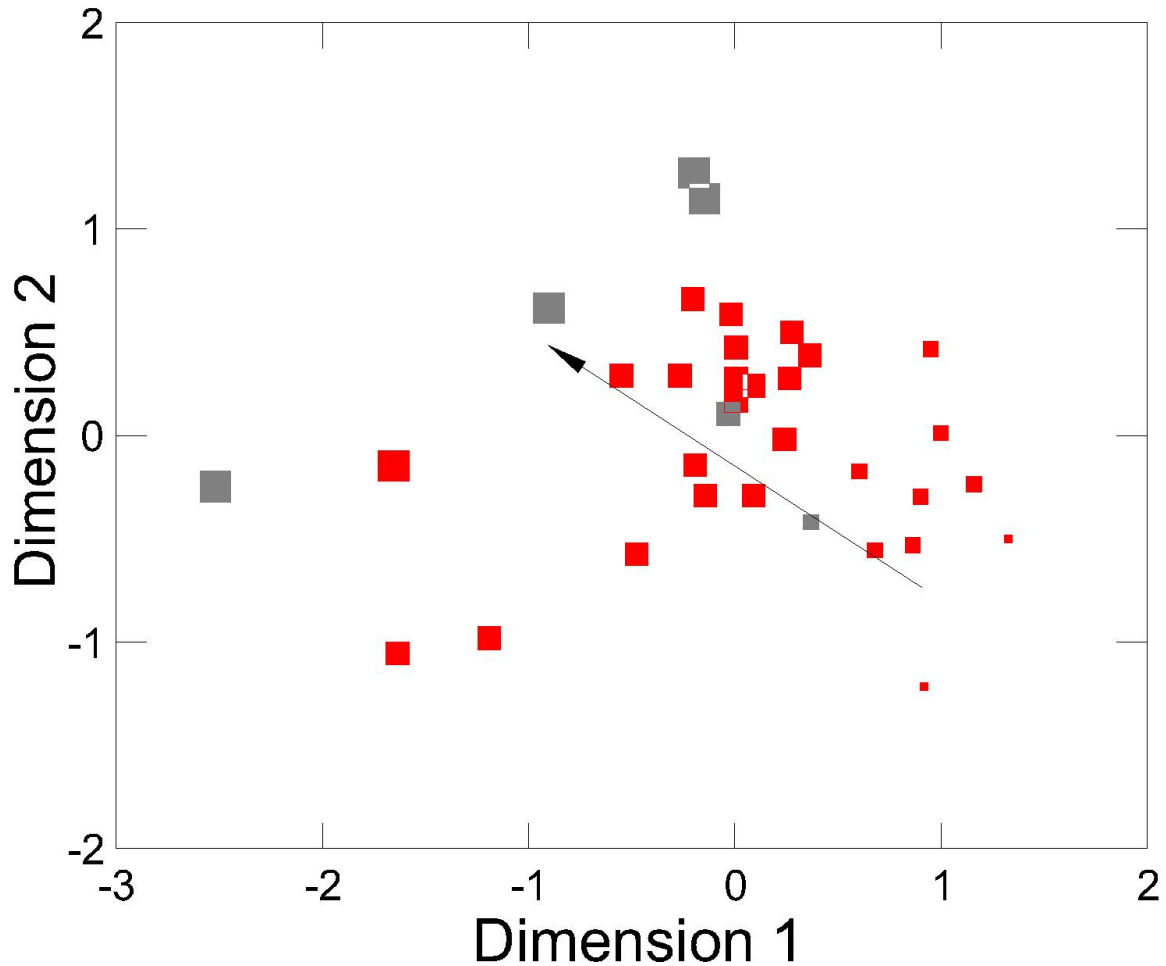


Figure 3.1 Plot of Variable 5 – Storage vessels (Sherds as a proportion in sherds of identifiable vessel form, larger squares representing higher proportions; grey squares are the household units with fewer than 384 sherds of various vessel forms)

Actually, the sizes of the samples of sherds from the 34 household units range from around 100 to thousands of sherds in total. In order to consider carefully the effects caused by small sample size, this study takes an estimate of the number of total sherds needed in order to consider the sample a highly reliable indicator of the proportional composition of the ceramic assemblages of each household unit. With a conservative guess of 50% of sherds of various vessel forms and a 95% confidence level, a random sample of sherds regardless of vessel forms from a household unit of at least 384 could be said to be highly reliable (t for unknown degrees of freedom at 95%

confidence = 1.96). This means that a household unit with more than 384 sherds in total could be considered a highly reliable representation of ceramic assemblage in the household unit. Thus, household units with a sample size of total sherds lower than 384 are displayed in grey in the plot to indicate that they are less reliable.

Although 6 household units are considered to be less reliable in terms of their sample size of total sherds, there is no sharp division shown in this two-dimensional plot. Instead, there is a gradual variation from fairly low proportions of storage vessels sherds in the lower right, to moderate proportions in the middle and then to the highest proportions at the upper left edge of the two-dimensional configuration. In this case, wealth among the household sample would seem to correspond to the proportions of storage vessel sherds, from low wealth in the lower right to higher wealth broadly on the left. A different amount of stored goods suggests a different capacity in procurement and consumption of necessary or socially valued goods and in access to exchanged services among the households in this sample.

3.1.2 Variable 7 – Ornaments

Two-dimensional plot of Variable 7 – ornaments (Figure 3.2) reveals how the number of ornaments divided by the number of sherds of identifiable vessel forms in each household unit in this sample behaves. Larger squares represent a household unit with a larger proportion of the ornaments. In this sample, ornaments seem to be really rare, compared to the storage vessels, with a proportion ranging from only about 0.04% to about 0.9% (Table 3.1). The ratio of the number of ornaments divided by the number of sherds of identifiable vessel forms of each household unit with ornaments ranges from about 1 ornament per 2500 sherds of identifiable vessel forms to about 1 ornament per 111 sherds of identifiable vessel forms.

However, it must be noted that the sherds of identifiable vessel forms range from only about 34 to thousands, and some household units were not found with ornaments. If 1 ornament per 2500 sherds of identifiable vessel forms is a low rate, then we cannot confidently say a household unit with 50 sherds of identifiable vessel forms and no ornaments really has a lower ornament ratio than a household unit with 1 ornament per 2500. In order to take into consideration carefully the effects caused by the zero values for ornaments and the small sample size, this study takes a further look at the ornament ratios among the household units found with ornaments and finds the median of the ratios (the number of ornaments divided by the number of sherds of identifiable vessel forms) is 0.002. This ratio means that we would only expect one or more ornaments if the number of sherds of identifiable vessel forms is greater than 500. So, when no ornaments are found for household units with a sample of fewer than 500 sherds of identifiable vessel forms, it is uncomfortably likely that these zero results may only be the result of the large amount of random noise in small samples. Therefore, this study displays those household units (11) with a sample of fewer than 500 sherds of identifiable vessel forms in grey in figure 3.2.

The low ratio range indicates a really small consumption of ornaments among this household sample. Such access to ornaments, even in small amount, still indicates the capacity to consume of valuable goods and this capacity would represent wealth. Only 19 household units in this sample (including 4 less reliable cases) consumed ornaments, more or less. Although the proportions of ornaments are low, they start low in the lower right, rise gradually up in the middle, and then are highest at the upper left edge of the two-dimensional configuration. Such gradual variation behaves just like variable 5 – storage vessels, suggesting that the number of ornaments also indicates wealth among the household sample in conjunction with storage vessels.

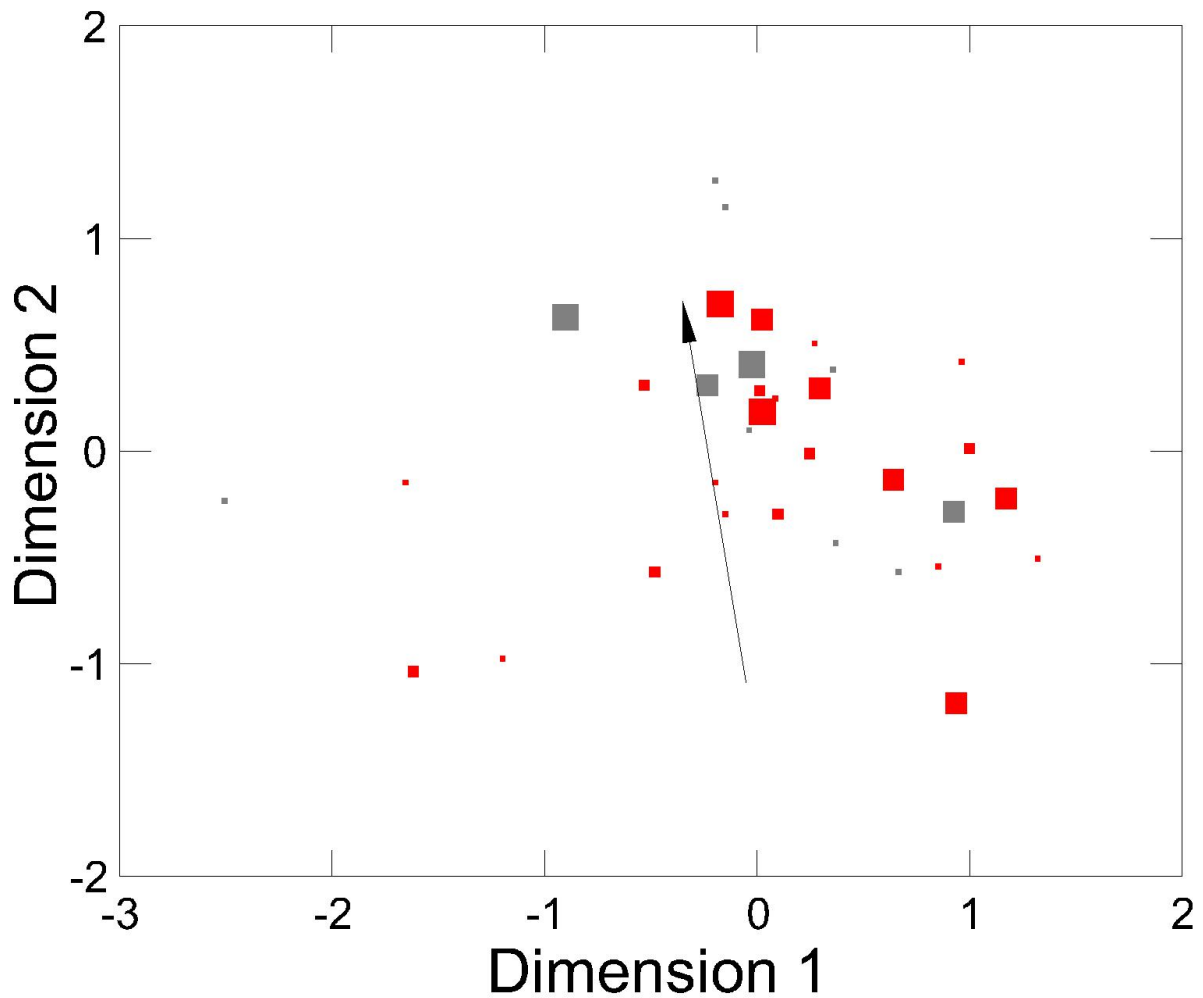


Figure 3.2 Plot of Variable 7 – Ornaments (the number of ornaments as a proportion in sherds of identifiable vessel form, larger squares representing higher proportions; grey squares are the household units with fewer than 500 sherds of identifiable vessels)

3.1.3 Variable 6 – Food preparation artifacts

A similar trend can be seen in the two-dimensional scaling showing proportions of variable 6 – food preparation artifacts (Figure 3.3). Each square represents the number of food preparation artifacts divided by the number of sherds of identifiable vessel forms from each household unit in this sample, and the larger squares represent household units with larger proportions of food

preparation artifacts. The proportions range from about 0.2% to about 2.7%, for almost every household unit (Table 3.1) except the three household units without any food preparation artifacts, and two of these three are samples represented by very small numbers of sherds.

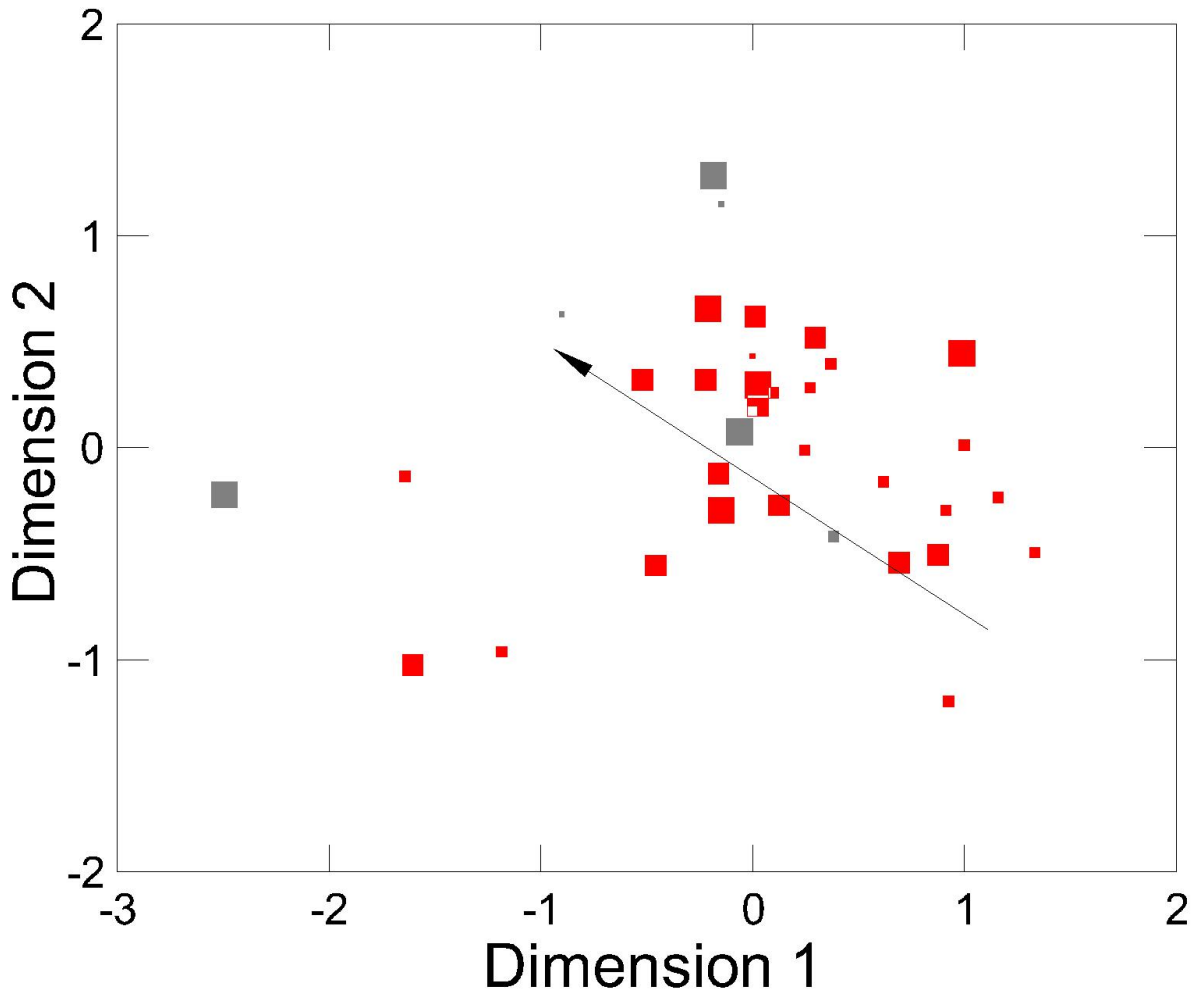


Figure 3.3 Plot of Variable 6 – Food preparation artifacts (larger squares indicate higher proportion of food preparation artifacts; grey squares are the household units with fewer than 348 sherds of various vessel forms)

However, the rates of food preparation artifacts can range from about 1 food preparation artifact per 500 sherds of identifiable vessel forms to 1 food preparation artifact per 37 sherds of identifiable vessel forms. If we say 1 food preparation artifact per 500 sherds of identifiable vessel forms is a low rate, then the household units with about 34 to 300 sherds of identifiable vessel

forms and no food preparation artifacts are potentially the result of the large amount of random noise in small samples. Thus, the zero results and the small sample size of the sherds of identifiable vessel forms must be carefully dealt with. The median of the ratios (the number of food preparation artifacts divided by the number of sherds of identifiable vessel forms of each household unit) among the household units found with food preparation artifacts is 0.007. This means there is probably one or more food preparation artifact per 143 sherds of identifiable vessel forms. Those household units (3) with a sample of sherds of identifiable vessel forms lower than 143 would be the less reliable cases, compared to other cases represented by a larger sample size. Considering that there are 6 household units with a sample size of sherds regardless of vessel forms lower than the sample size for reasonable confidence (384) and these 6 household units include the 3 with a sample size of sherds of identifiable vessel forms lower than 143, it is safer to count the 6 household units together as less reliable cases. In figure 3.3, these less reliable cases are displayed in grey.

A different amount of food preparation artifacts suggests the household units varied in the requirement for preparing food and, possibly, the capacity to refresh the food recipe according to the possible functions of the food preparation artifacts. There is no sharp division, but a gradual variation in the two-dimensional configuration: starting from fairly low proportions of food preparation artifacts in the lower right, and climbing to the highest at the upper left. Such gradual variation behaves like variable 5 – storage vessels, indicating that food preparation artifacts are also indicators of greater wealth.

3.1.4 Variable 2 – Incising/stamping in complex patterns

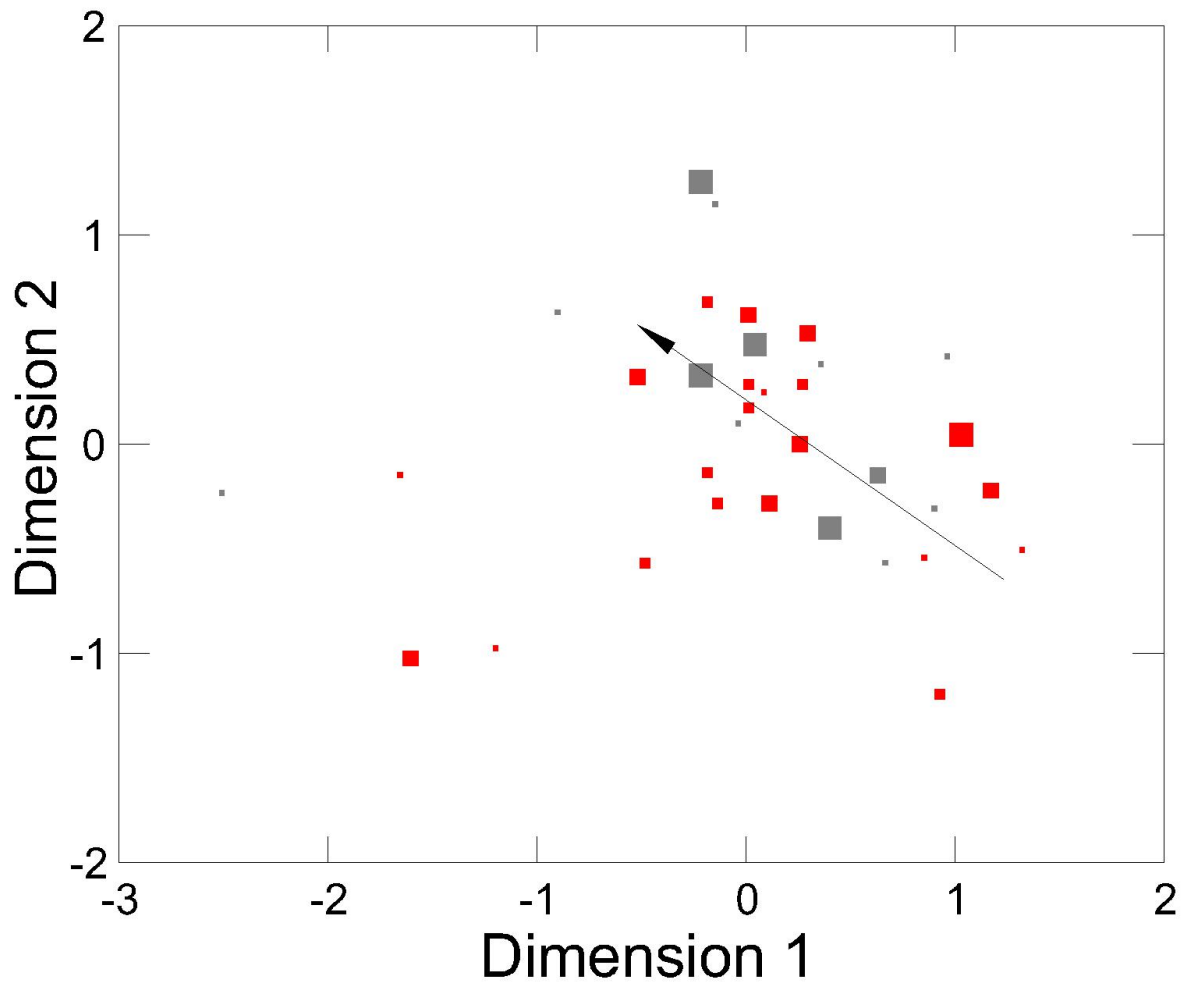


Figure 3.4 Plot of Variable 2 – Incising/stamping in complex patterns (larger squares indicate higher proportions of sherds with incising/stamping in complex patterns; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

The variable of incising/stamping in complex patterns behaves in a similar way to variable 5 – storage vessels (Figure 3.4). Each square in the plot represents a household unit, and larger squares indicate a higher proportion of sherds with incising/stamping in complex patterns. The proportions of sherds with incising/stamping in complex patterns are relatively low, ranging from about 0.03% to about 1% (Table 3.1).

In addition, it must be noted that the denominators for variable 2 – incising/stamping in complex patterns are the total number of sherds. The rate of 0.03% means about one sherd with incising/stamping in complex patterns per 3000 sherds. If this is true low rate for variable 2, the household units with only hundreds of sherds may still have some sherds or vessels decorated with incising/stamping in complex patterns decoration. Thus, the effects of zero results and small sample size must be considered carefully. The median of the ratios (number of sherds with incising/stamping in complex patterns divided by total number of sherds of each household unit) among the household units found with vessels or sherds decorated by incising/stamping in complex patterns is 0.001. This means that probably every 1000 sherds will have one sherd or more with incising/stamping in complex patterns. Thus, household units (13) with a sample size lower than 1000 sherds regardless of vessel forms would be less reliable than others represented by larger samples. These less reliable cases are displayed in grey in Figure 3.4. Compared to variable 6 – food preparation artifacts and variable 7 – ornaments, the rate of sherds decorated with incising/stamping in complex patterns seems not that rare.

There are 21 household units (including 5 less reliable cases) in this sample found with ceramic vessels decorated with incising/stamping in complex patterns. The variation of the proportions of sherds with incising/stamping in complex patterns also shows relatively gradual variation, starting from fairly low proportions at the lower right that rise gradually toward the upper part of the two-dimensional plot. This variation, to some extent, echoes the gradual variation shown by the proportions of storage vessels and suggests that higher proportions of ceramic vessels decorated with incising/stamping in complex patterns are also an indicator of greater wealth.

These four variables, then, pattern in a similar way in the space defined by the two-dimensional configuration. The four variables all form a gradual variation, to some extent, running

from lower values in the lower right to higher values in the upper left in the plot of Dimensions 1 and 2. The households where the proportions of storage vessels are high are likely to be household units where the proportions of the ornaments, food preparation artifacts, and sherds with incising/stamping in complex patterns are also high. This suggests the household units with high proportions of storage vessels tend strongly to be the household units which consumed more ornaments, food preparation artifacts, and ceramic vessels with incising/stamping in complex patterns. All four variables can reasonably be connected to economic well-being or standard of living. This pattern probably reflects the wealth differentiation among the 34 household units' sample.

The question might be raised of whether the high proportions of storage vessels alongside high proportions of food preparation artifacts and ornaments could represent larger numbers of people in a household instead of a wealthier household because more people need more food supply and storage, and food sharing, and thus could produce more refuse. The consistently small housing structures at Erlitou, however, were likely to be occupied by nuclear families with very limited variation in numbers of members. In addition, the variables of this study are proportions, indicating the relative abundance of one type of artifact against artifacts for other purposes. They are not frequencies or numbers of objects so, for example, the storage vessel variable does not indicate the total amount of storage capacity in one household. In this way, a larger family might need a larger storage capacity, but it would also require more serving vessels and other kinds of vessels, so the proportion of storage vessels would not be larger for large households than for smaller ones. Moreover, the proportions of storage vessels and food preparation artifacts correlate with the proportions of ornaments and sherds with incising/stamping in complex patterns, lending

further support to the idea that these variables represent a consistent package of artifacts related most convincingly to wealth differentiation.

3.2 Discussion

The Erlitou settlement has been interpreted as a capital with complex functional divisions (Xu 2009 and 2022). The palatial enclosure, standing in the center of the site, was occupied by the ruling elites and their families. Ruling elites' families and intermediate elites are expected to be tremendously wealthy household units with high consumption of storage vessels, food preparation artifacts, vessels with incising/stamping in complex patterns, and luxury ornaments. If the commoners were completely excluded from the palatial enclosure, thus, we would expect to see some clear gap between the household units in or near the palatial enclosure and the household units from other locations. The household units in or near the workshop enclosure and in the east end of the site also may stand far from the cluster of household units in or near the palatial enclosure. However, the household units this research studies do not show a clear separation by locations in the level of wealth. And they must fall pretty low on the wealth scale, certainly below the realm of the truly impressive wealth of Erlitou elites.

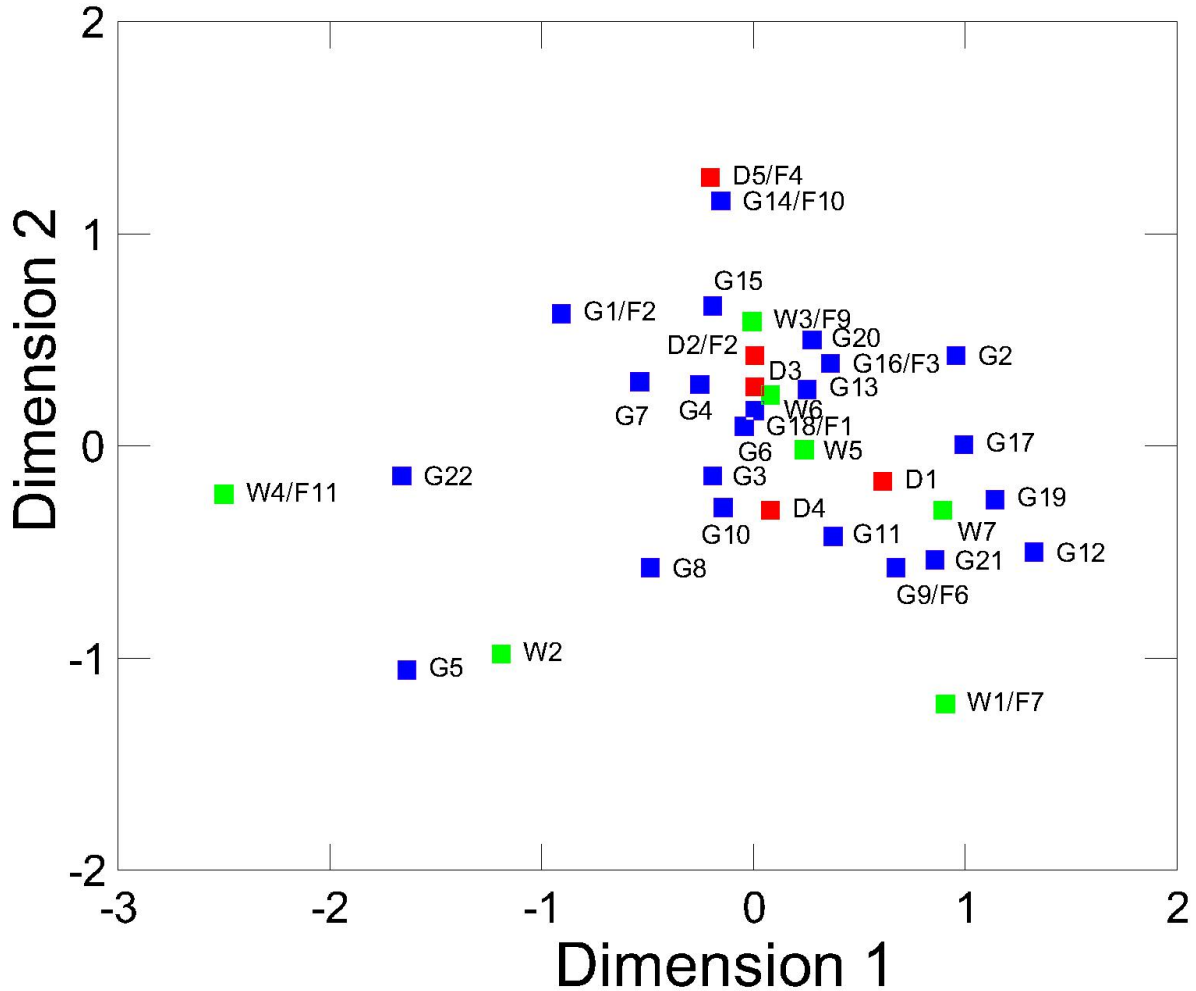


Figure 3.5 Household units from different regions in different colors

(Household units in or near the palatial enclosure in blue, household units in or near the workshop enclosure in green, and household units in the east end of the site in red)

The household units in or near the palatial enclosure, in or near the workshop enclosure, and in the east end of the site are respectively displayed in different colors in Figure 3.5. The household units from the three locations are all thoroughly mixed together, with no tendency to separate into sections by location. As we can see in the Figure 3.5, The household units in or near the palatial enclosure (blue squares) are scattered in several directions; although most are located in the middle of the plot, some are standing out to the upper left corner, possibly the wealthy ones, and some are standing in the right and even reaching out to the lower right, possibly the less

wealthy ones. There is no clear cluster of only household units in or near the palatial enclosure forming close to the left, or upper left corner. The household units in or near the workshop enclosure and in the east end (green squares and red squares), although only a small number in this sample, also scatter in several directions in this two-dimensional plot; some are reaching out to the upper left, while some are standing in the lower right. There is also no cluster of only household units in or near the workshop enclosure, or in the east end of the site, forming in the lower right. In a word, the household units from the three locations are mixed together through the wealth distribution pattern in the configuration space. Such patterning suggests all the 34 household units in this sample from the three locations probably shared a general range of wealth. They must fall pretty low on the wealth scale, certainly below what would be expected of “intermediate elites” and entirely outside of the realm of the truly impressive wealth of Eritou elites.

At the same time, the 34 household units are spread pretty widely through the wealth distribution pattern in the configuration space. The scattering also suggests that the 34 household units in this sample varied in opportunity to accumulate wealth, and did not share the exact same level of wealth in terms of standard of living.

There has been an assumption that people living the above-ground housing structures, especially the medium- or small-size rammed earth buildings, should be higher in rank than those sheltered in the semi-subterranean house structures at Erlitou, but such “being higher in rank” does not make any distinction between wealth and prestige, suggesting being higher in rank involves both wealth and prestige (Zhongguo 2014 and 2019; Xu 2009 and 2022). It is true that an above-ground house structure requires more labor to construct. According to Xu (2009 and 2022), the Palatial Platform No. 1, with an area of about 10000 m², including a 900 m² main palace building and a courtyard with an area of about 5000 m², took 200,000 working days to complete this

construction with 1000 laborers creating 0.1 m³ of rammed earth volume per day. It also seems superficially obvious that those occupying the small above-ground housing structures, although they were much smaller than the palatial structures, must have been wealthier than those living in the semi-subterranean structures. In Figure 3.6, the household units living in the small above-ground housing structures are displayed in red and the household units that occupied semi-subterranean housing structures are in green. It is pretty clear that the household units living in the small above-ground housing structures are standing more upper left (in the wealthier part) than the household units living in the semi-subterranean housing structures in the configuration space. Such patterning indicates that the artifact assemblages consumed by the household units in the small above-ground housing structures indeed differed from those consumed by the household units in the semi-subterranean housing structures, to some extent; in other words, the household units in the small above-ground housing structures were wealthier than the household units in the semi-subterranean housing structures. Thus, there is a correspondence between the wealth indications of household artifact assemblages and residential architecture. This conclusion is very interesting, but only suggestive and tentative, in that it is based on a very small sample, especially of the household units with clear housing structures; only 2 household units were sheltered in semi-subterranean housing structures, only 5 household units were living in small above-ground structures, 3 household units had indeterminate structures because of poor preservation, and the other 24 household units are only represented by artifact samples from locations where housing structures were not recovered. And although the 5 household units in the small above-ground structures are in the high-wealth part of the scaling space, 3 of them are represented by the less reliable small artifact samples.

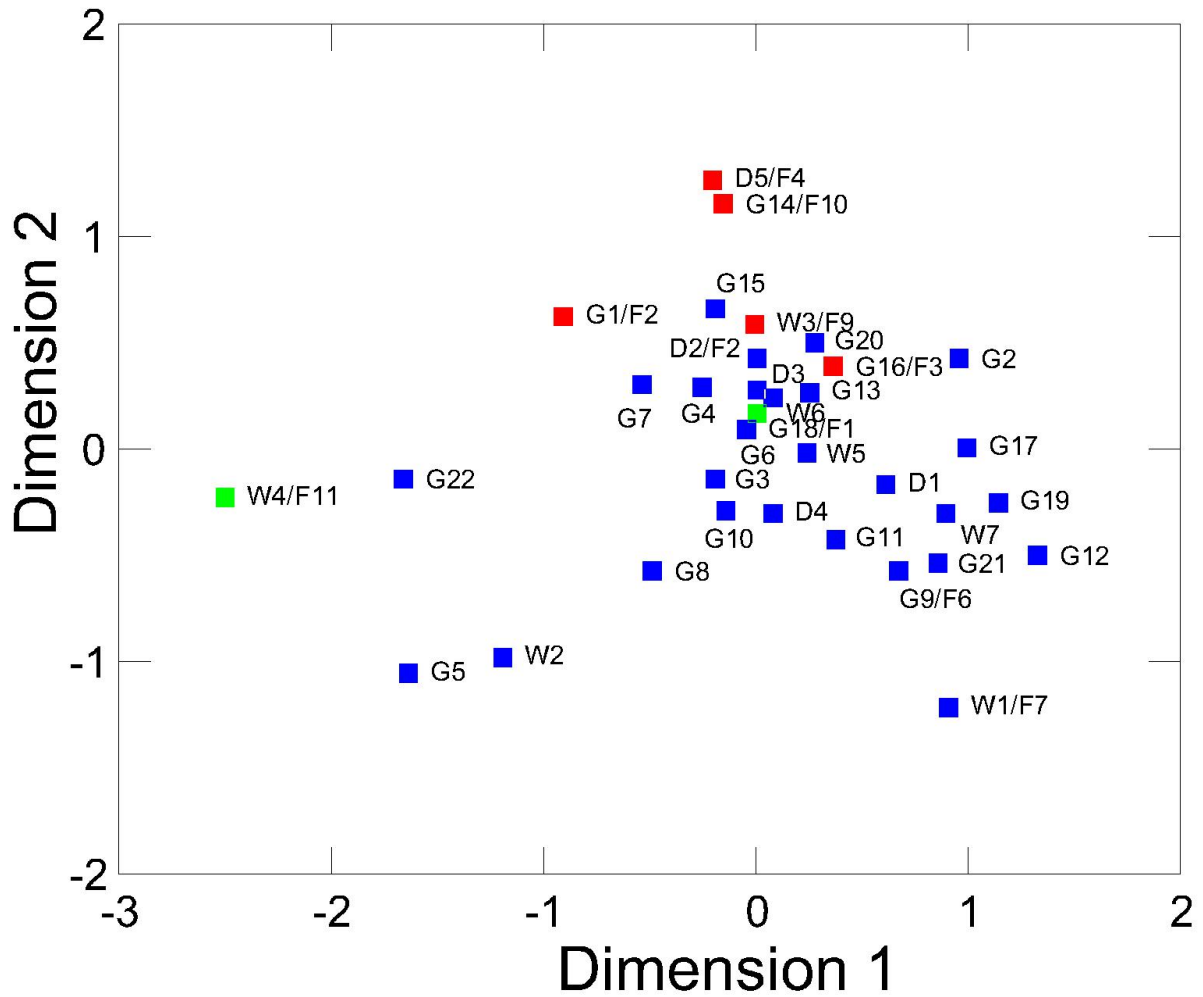


Figure 3.6 Household units colored by different housing structures

(Household units living in the small above-ground housing structures in red, household units occupying the semi-subterranean housing structures in green, household units with unknown housing structures in blue.)

Table 3.1 Proportions of the variables related to wealth differentiation in the 34 household units

Household unit	Incising/stamping in complex patterns	Storage vessels	Food preparation artifacts	Ornaments
G1/F2	0.0000	0.5427	0.0000	0.0061
G2	0.0000	0.3894	0.0133	0.0000
G3	0.0008	0.4356	0.0066	0.0000
G4	0.0024	0.4732	0.0063	0.0032
G5	0.0021	0.4693	0.0080	0.0013
G6	0.0000	0.4400	0.0267	0.0000
G7	0.0016	0.4984	0.0076	0.0011
G8	0.0007	0.4223	0.0080	0.0004
G9/F6	0.0000	0.3360	0.0102	0.0000
G10	0.0006	0.4192	0.0218	0.0000
W1/F7	0.0006	0.2712	0.0032	0.0016
W2	0.0000	0.4466	0.0032	0.0000
D1	0.0021	0.3776	0.0050	0.0025
D2/F2	0.0023	0.4629	0.0000	0.0089
G11	0.0040	0.3681	0.0055	0.0000
G12	0.0000	0.2953	0.0034	0.0000
G13	0.0003	0.4283	0.0020	0.0020
G14/F10	0.0000	0.5294	0.0000	0.0000
G15	0.0007	0.4907	0.0244	0.0044
G16/F3	0.0000	0.4331	0.0029	0.0000
W3/F9	0.0011	0.4765	0.0098	0.0020
W4/F11	0.0000	0.5962	0.0192	0.0000
W5	0.0010	0.4100	0.0059	0.0007
W6	0.0000	0.4424	0.0050	0.0000
W7	0.0000	0.3393	0.0030	0.0030
D3	0.0005	0.4511	0.0153	0.0012
D4	0.0015	0.3998	0.0062	0.0004
D5/F4	0.0101	0.5385	0.0154	0.0000
G17	0.0027	0.3560	0.0039	0.0006
G18/F1	0.0006	0.4419	0.0080	0.0040
G19	0.0013	0.3238	0.0050	0.0025
G20	0.0014	0.4473	0.0113	0.0000
G21	0.0000	0.3240	0.0078	0.0000
G22	0.0000	0.5306	0.0018	0.0000

4.0 Prestige differentiation within the Erlitou household sample

4.1 Patterns of the variables correlated to prestige in the two-dimensional configuration

This chapter will explore the patterning of household assemblage variables related to prestige differentiation in the two-dimensional multidimensional scaling configuration presented in Chapter 2. These variables include *Variable 1 – Finger-nail incising*, *Variable 3 – Polishing*, and *Variable 4 – Feasting utensils and vessels*.

4.1.1 Variable 3 – Polishing

Figure 4.1 is the two-dimensional configuration indicating values of Variable 3 - polishing showing how the proportions (the number of polished vessels or sherds divided by the number of sherds regardless of vessel forms of each household unit) behave in this sample. Each square in the plot represents a household unit with polished vessels or sherds, and larger squares indicate higher proportions of polished vessels or sherds. The proportions of sherds with polishing are relatively low, ranging from about 3.3% to about 34% (Table 4.1). Such variation reflects that the household units in this sample have different capacities in serving and storing food and fermented beverages in polished vessels.

Although every household unit in this sample has some polished vessels or sherds, more or less, the effects of small sample size must be taken into consideration carefully. The median of the ratios (number of sherds with polishing divided by the total number of sherds for each household unit) is 12.4%. This means that for every 8 sherds there will be one or more polished

sherd. Thus, those household units with a sample size less than 8 sherds regardless of vessel forms would be less reliable. There is no household unit with only 8 sherds or less, but according to the conservative estimate in the Chapter 3, this study takes a random sample of sherds, regardless of vessel forms, to be more reliable if it has at least 384 (t for unknown degrees of freedom at 95% confidence = 1.96). There are 6 household units with a sample size fewer than 384 sherds regardless of vessel forms. It is worth counting all the 6 household units as less reliable cases, compared to other cases represented by a larger sample size of sherds. In figure 4.1, these less reliable cases are displayed in grey.

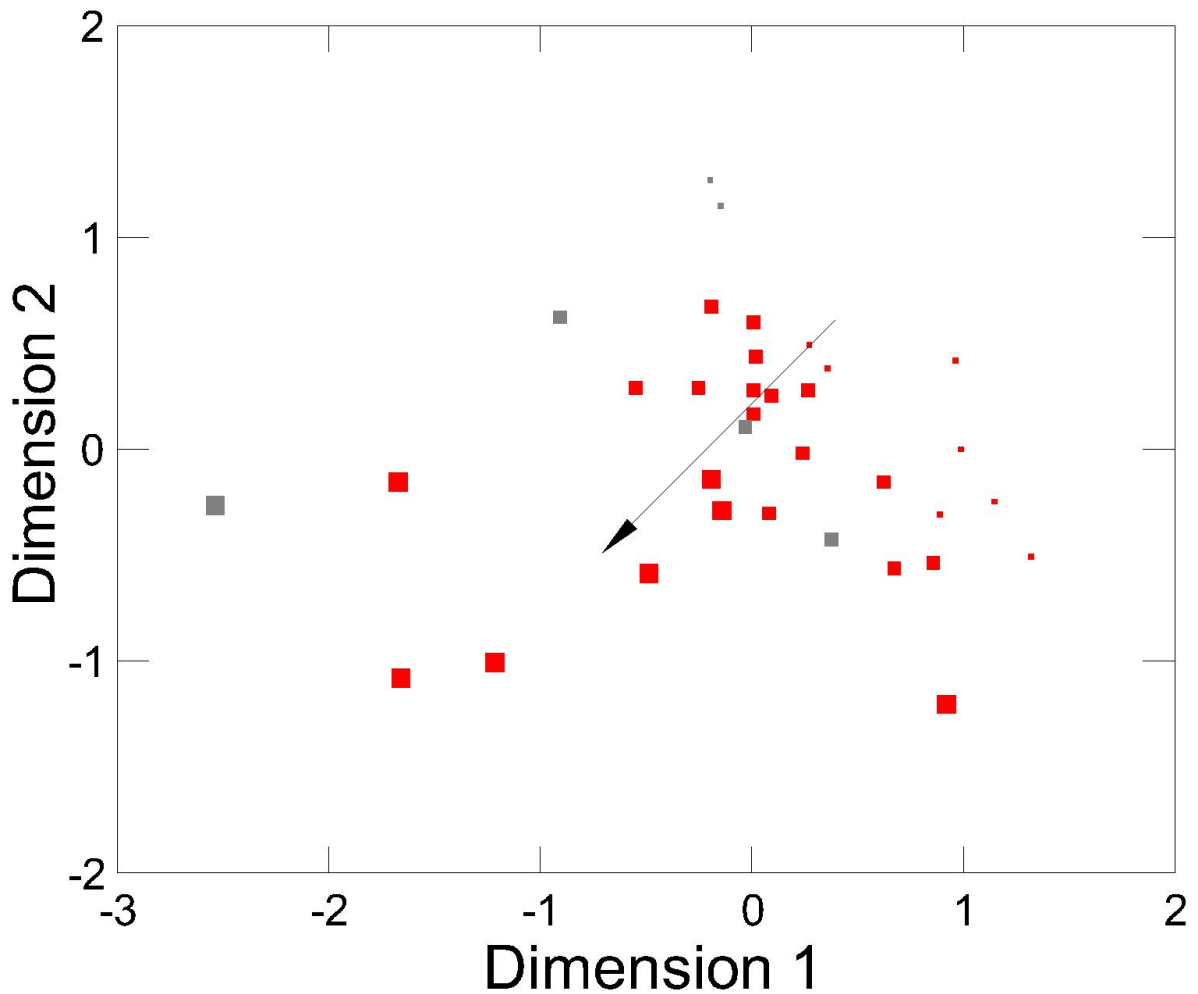


Figure 4.1 Plot of Variable 3 – Polishing (larger squares indicate higher proportion of polished sherds; grey squares are the household units with fewer than 384 sherds of various vessel forms)

Although there are 6 household units which may be less reliable in terms of sample size, there is no sharp division in this two-dimensional plot, but rather a gradual variation starting from fairly low proportions of polished vessels or sherds in the upper right, rises moderately in the middle and then reaches its highest values at the lower left edge of the two-dimensional configuration. Thus, the consumption of polished vessels in the household sample is relatively less in the upper right but more on the left. This pattern suggests the household units standing more to the lower left tend to be more capable of serving and storing food and fermented beverages in polished vessels among the households in this sample.

4.1.2 Variable 4 – Feasting utensils and vessels

Figure 4.2 is the two-dimensional configuration plot showing the 34 household units in this sample indicating the values of Variable 4 – feasting utensils and vessels. Each square in this figure represents the ratio of the number of feasting utensils and sherds of feasting vessels divided by the number of sherds of identifiable vessel forms in each household unit. Larger squares represent a household unit with a larger proportion of feasting utensils and sherds of feasting vessels. All household units in this sample have some feasting utensils and vessels, in a proportion ranging from about 1.5% to about 15% (Table 4.1). This range is large and could indicate real differences in the capabilities of arranging feasting activities for prestige.

The median of the ratios of feasting utensils and sherds of feasting vessels is 0.051. This means that there is probably one or more feasting utensils or sherds of feasting vessels per 20 sherds of identifiable vessel forms. There is not one household unit with only 20 sherds or less of identifiable vessel forms. However, it is still necessary to take into careful consideration the possible effect caused by the small sample size. There are 6 household units with a sample size of

sherds regardless of vessel forms fewer than the confidently representative sample size (384). Thus, those household units (6) are considered less reliable cases than others represented by a larger sample size, and they are displayed in grey in the plot.

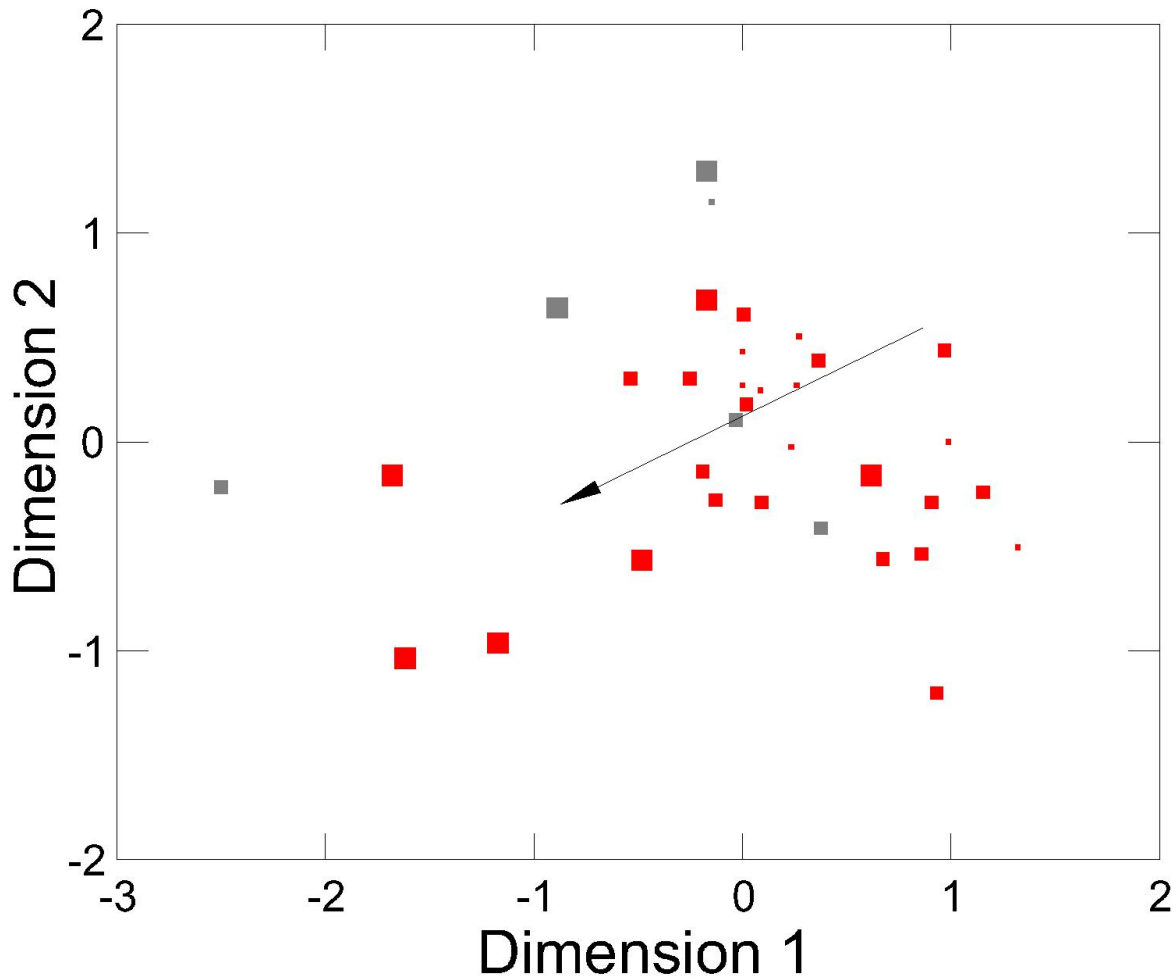


Figure 4.2 Plot of Variable 4 – Feasting utensils and vessels (as a proportion in sherds of identifiable vessel form, larger squares representing higher proportions; grey squares are the household units with fewer than 384 sherds of various vessel forms)

Although there are 6 household units considered less reliable in terms of their sample size, no sharp division is shown in this two-dimensional plot, but rather a gradual variation. The gradual variation starts from fairly low proportions of feasting utensils and vessels in the upper right, rises moderately in the middle and then moves to the highest values at the lower left edge of the two-

dimensional configuration. This suggests that household units with low prestige are in the upper right and household units with higher prestige are broadly on the left side of the configuration. A different amount of feasting utensils and vessels suggests a different capacity in arranging and hosting feasting activities, sharing food and fermented beverages, and serving in ancestral veneration and other festive ceremonies among the households in this sample.

4.1.3 Variable 1 – Finger-nail incising

The variable finger-nail incising behaves in a similar way to Variable 3 – polishing and Variable 4 – feasting utensils and vessels (Figure 4.3). Each square in the plot represents a household unit with the sherds decorated with finger-nail incising, and larger squares indicate a higher proportion of sherds with finger-nail incising. The proportions of sherds with finger-nail incising decoration are relatively low, ranging from about 0.1% to about 1.9% (Table 4.1).

In contrast to variable 4 – feasting utensils and vessels, the denominators for variable 1 – finger-nail incising are the total number of sherds. The rate of 0.1% means about one sherd with finger-nail incising per 1000 sherds. If this is a true low rate for variable 1, the household units with only hundreds of sherds and no sherds or vessels decorated with finger-nail incising are possibly the result of the large amount of random noise in small samples. Thus, the effects of zero results and small sample size must be taken into consideration carefully. The median of the ratios (number of sherds with finger-nail incising decoration divided by the total number of sherds of each household unit) among the household units found with vessels or sherds decorated by finger-nail incising is 0.6%. This means that there will probably be one or more sherds with finger-nail incising for every 167 sherds. Thus, those household units with a sample size less than 167 sherds regardless of vessel forms will be considered less reliable. There are 6 household units with a

sample of fewer than 384 sherds, and these will be considered less reliable cases, compared to others represented by larger samples. In figure 4.3, these less reliable cases are displayed in grey.

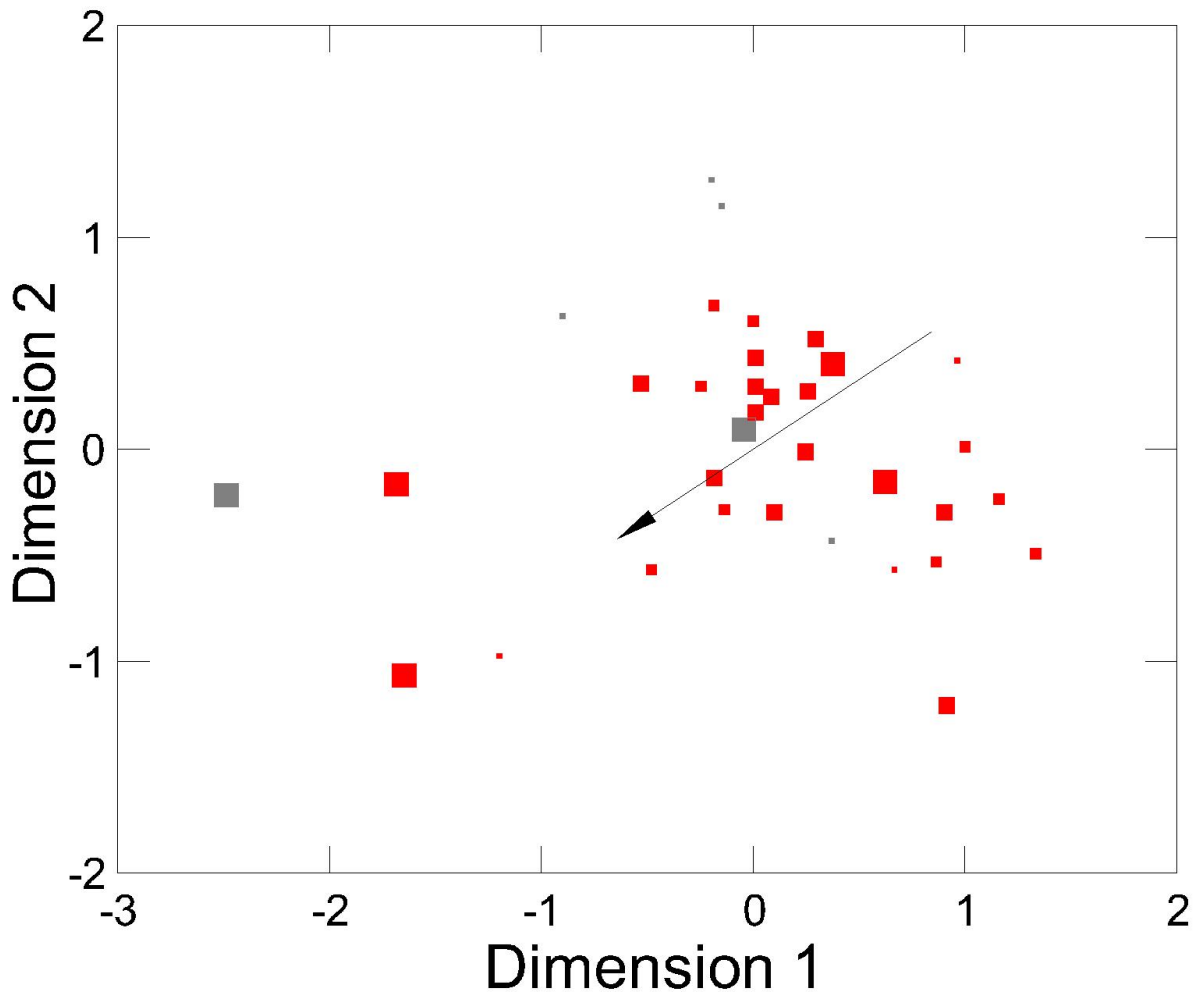


Figure 4.3 Plot of Variable 1 – Finger-nail incising (larger squares indicate higher proportion of sherds with finger-nail incising; grey squares are the household units with fewer than 384 sherds regardless of vessel forms)

There are 27 household units (including 2 less reliable cases) in this sample found with ceramic vessels or sherds decorated with finger-nail incising. The variation of the proportions of vessels or sherds with finger-nail incising is relatively gradual, starting from fairly low proportions at the upper right and rising to higher proportions in the lower left part of the two-dimensional plot. Such variation, to some extent, echoes the gradual variation shown by the proportions of

polished vessels and feasting utensils and vessels. This suggests that prestigious household units also consumed more ceramic vessels decorated with finger-nail incising, perhaps serving and storing food and fermented beverages in vessels decorated with finger-nail incising.

These three variables, then, pattern in a relatively similar way in the space defined by the two-dimensional configuration. The three variables all form a gradual variation, running from lower values in the upper right to higher values in the lower left in the plot of Dimensions 1 and 2. The households where the proportions of feasting utensils and vessels are high are likely to be the household units where the proportions of vessels or sherds with polishing and finger-nail incising are high. One may question why polishing and finger-nail incising are treated as prestige indicators here instead of as wealth indicators in Chapter 3. Generally, extra labor in ceramic production by decoration application would increase the value/cost of the pottery (Smith 1987; Costin and Earle 1989). However, in the scaling space of this Erлитou household sample, polishing and finger-nail incising correlate with feasting utensils and vessels rather than with storage vessels, food preparation artifacts, ornaments, and incising/stamping in complex patterns, suggesting that polishing and finger-nail incising at Erлитou did not simply correlate with the labor value and did not simply represent economic capacity of one household in consuming good ceramics but connected more to feasting and prestige. Thus, all three variables serve together as indicators of prestigious social status.

One may also question whether more feasting utensils and vessels may be because of more residents in some households rather than because of their prestige. It is possible that the proportion of utensils and vessels simply for eating and drinking may be correlated to the number of people residing in a house, but if the family size is generally similar, the wealthier or prestigious families would consume more objects and produce more refuse. As Chapter 1 shows, the Erлитou

consistently small housing structures were likely to contain nuclear families. In addition, feasting utensils and vessels do not run in the same direction as wealth differentiation (see further discussion comes below), so feasting utensils and vessels are more likely to represent prestige differentiation. Moreover, feasting utensils and vessels are represented as a proportion, not as abundance or frequency. If there are more feasting utensils and vessels in a large family, there would also be more storage vessels and other kinds of vessels, so the proportion of feasting utensils and vessels would not be greater for large households than for smaller ones. Feasting utensils and vessels correlate strongly with polishing and finger-nail incising, further suggesting that these two variables are also indicators of prestige differentiation.

4.2 Discussion

The ruling elites' families of the Erlitou state, who are presumed to occupy the palatial enclosure, and the intermediate elites are expected to be tremendously prestigious household units who must consume more exquisite feasting utensils and vessels, and have more capacity in serving and storing food and fermented beverages in polished vessels or ceramic vessels decorated with finger-nail incising (or maybe other complex, exquisite decoration patterns). If the palatial enclosure were completely forbidden to the commoners, we would expect to see some clear gap between the household units in or near the palatial enclosure and the household units from other locations. The household units in or near the workshop enclosure and in the east end of the site also may stand far from the cluster of household units in or near the palatial enclosure. However, the household units in this sample do not show a clear separation by location in terms of prestige.

And they must fall pretty low on the prestige scale, certainly below the realm of the truly impressive prestige of Erlitou elites.

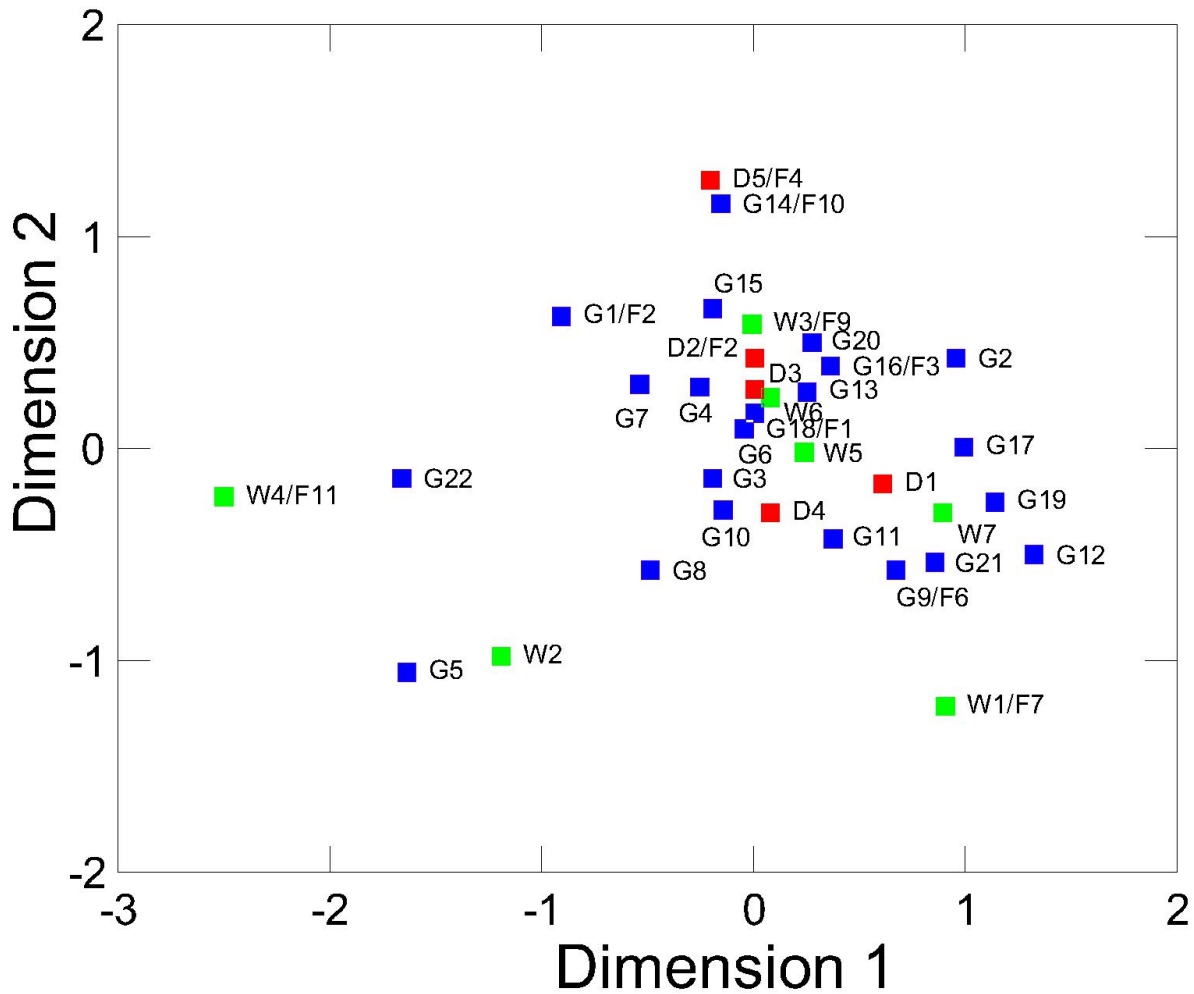


Figure 4.4 Household units from different regions in different colors

(Household units in or near the palatial enclosure in blue, household units in or near the workshop enclosure in green, and household units in the east end of the site in red)

Displayed in different colors in Figure 4.4, the household units in or near the palatial enclosure, in or near the workshop enclosure, and in the east end of the site are all thoroughly mixed together. The household units in or near the palatial enclosure (blue squares) are scattered in several directions; although most are located in the middle of the plot, some are standing out to the lower left corner, possibly the most prestigious ones, and some are standing in the right and

even reaching out to the upper right, possibly the less prestigious ones. There is no clear cluster of only household units in or near the palatial enclosure forming close to the left, or even farther to lower left corners. The household units in or near the workshop enclosure (green squares), although only a small number in this sample, also scatter in several directions in this two-dimensional plot; some are reaching out to the lower left, while some are standing in the right. However, the household units in the east end of the site (red squares) tend to only appear in the middle and upper right of the plot, possibly standing in the low to moderate level of prestige. In a word, most of the household units from the three locations in this sample are mixing up together in the scale of prestige in the configuration space, but there are still four most prestigious household units in this sample in the lower left corner of the scaling space, 2 from the palatial enclosure and 2 from the workshop enclosure, although one of the highly prestigious household units suffers from small sample problems. Such patterning suggests all the 34 household units in this sample from the three locations shared a pretty low social rank on the prestige scale, almost certainly below what would be expected of “intermediate elites” and were entirely outside of the realm of the truly impressive prestige of Eritou elites.

In the meantime, the 34 household units are spread pretty widely through the prestige pattern in the configuration space. The scattering patterning also suggests that the 34 household units in this sample varied in opportunity to negotiate and gain prestige, and did not share the same level of prestige in terms of feasting activities. But such negotiation of prestige among the commoners represented by this household sample was not based on economic power, or wealth, and indeed prestige did not correspond to wealth at all but crosscut it. According to the study of wealth differentiation in chapter 3, the relatively wealthy household units are located in the upper left in this plot, not in the lower left where the more prestigious households are. Wealthier

households were not more prestigious, and more prestigious households were not wealthier. Wealth and prestige were differentiated under different and unrelated mechanisms. Some prestigious household units are in the palatial enclosure, and some are in the workshop enclosure, while the household units in the east end of the site, although they tended to be relatively higher (at least moderate to high) in wealth, seem to be only low to moderate in prestige. There must be some other principles or mechanisms for the commoners to negotiate and gain prestige, at least in this household sample. It is possible that some of the relatively prestigious commoner families may have served the ruling elites and their families on a daily basis alongside other commoner families in the palatial enclosure, and formed a hierarchical attendant group. It is also possible that some prestigious commoner families, possibly specialized elite-oriented workers in the workshop enclosure, formed an administrative system in the elite-oriented worker communities, and the less prestigious families in the east end of the site, although they could be relatively wealthy, possibly had only a distant relationship to the royal court, and the ruling elites and their families. The prestigious household units in this sample were more likely to be in or near the palatial enclosure and the workshop enclosure than at the east end of the site. Being in or near the palatial enclosure and the workshop enclosure could demonstrate prestige among the commoners, to some extent. Such a tendency in residences may have contributed to the maintenance and protection of the ruling elites and their governance as well as enhance royal control of elite-oriented craft production and monopoly consumption of high-quality artifacts of turquoise and bronze, which have been identified in the workshop enclosure. Thus, prestige, among commoners, was probably part of being related to the royal court. In some ways, it echoes the residential pattern found by recent studies that elites (that is, much more prestigious families than commoners in the Erlitou community) were distributed in a centripetal pattern, more concentrated around the palatial

enclosure than the other places farther from the center of the site (Xu, Chen and Zhao 2004; Zhao 2020). In contrast, being in or near the palatial enclosure and the workshop enclosure was not necessary for household units in this sample to be wealthier. Wealthier families could appear not only in or near the palatial enclosure and workshop enclosure, but also in the east end of the site.

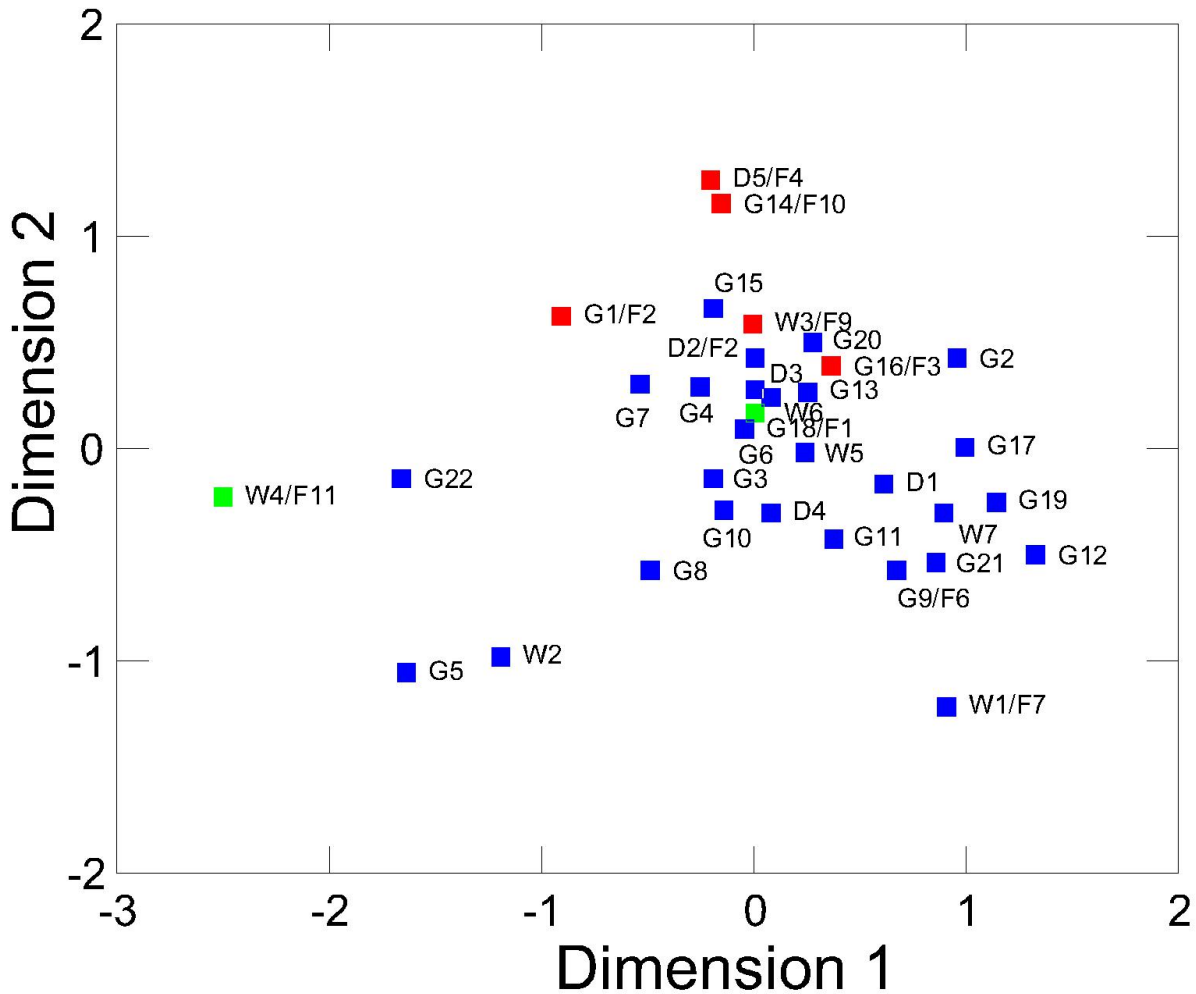


Figure 4.5 Household units colored by different housing structures

(Household units living in small above-ground housing structures in red, household units occupying semi-subterranean housing structures in green, household units with unknown housing structures in blue.)

On the other hand, people living in the above-ground housing structures, especially the medium- or small-size rammed earth buildings, have been assumed to be higher in rank than those in the semi-subterranean house structures at Erlitou (Zhongguo 2014 and 2019; Xu 2009 and

2022). It is common to conjecture that those occupying in the small above-ground housing structures, although much smaller in size than the palatial structures, must have been more prestigious than those living in the semi-subterranean structures because the prestige could enable the families to procure wealth and then be represented by their standard of living in some cases, and, in some other cases, some wealthy families could also gain their prestige through their economic power. However, this study shows that probably prestige was not gained by wealth, and wealth could not systematically create prestige among the commoners in this sample. In Figure 4.5, the household units living in the small above-ground housing structures are displayed in red and the household units occupying the semi-subterranean housing structures are in green. The household units in the semi-subterranean housing structures stand more lower left (in the more prestigious part of the configuration) than the household units living in the small above-ground housing structures; in other words, the household units living in the semi-subterranean housing structures in this sample tend to be relatively more prestigious than the household units living in the small above-ground housing structures. The analysis presented in Chapter 3 suggests that the household units living in the small above-ground housing structures are wealthier, and the household units living in the semi-subterranean housing structures are less wealthy, but this chapter finds the commoner households who lived in the semi-subterranean structures could be more prestigious than the commoners living in the small above-ground structures. This suggests that the standard of living of an Erilitou commoner household unit cannot confidently represent its prestige. It is interesting that household units living in the semi-subterranean housing structures could be more prestigious than those living in the small above-ground housing structures. But it must be remembered that this conclusion is based on a very small sample of clearly defined housing

structures, and semi-subterranean housing structures number only two. In addition, some of the household units with housing structures have less reliable small samples of sherds.

Table 4.1 Proportions of the variables related to prestige differentiation in the 34 household units

Household unit	Finger-snail incising	Polishing	Feasting utensils & vessels
G1/F2	0.0000	0.1564	0.0732
G2	0.0000	0.0331	0.0499
G3	0.0045	0.1669	0.0508
G4	0.0024	0.1357	0.0568
G5	0.0152	0.3393	0.0828
G6	0.0138	0.1330	0.0467
G7	0.0049	0.1594	0.0529
G8	0.0034	0.2138	0.0844
G9/F6	0.0000	0.1297	0.0570
G10	0.0034	0.1733	0.0503
W1/F7	0.0074	0.1636	0.0363
W2	0.0000	0.2993	0.0730
D1	0.0085	0.0983	0.1019
D2/F2	0.0069	0.1098	0.0237
G11	0.0000	0.1389	0.0549
G12	0.0009	0.0823	0.0148
G13	0.0081	0.0994	0.0319
G14/F10	0.0000	0.0658	0.0294
G15	0.0034	0.0998	0.0664
G16/F3	0.0092	0.0809	0.0552
W3/F9	0.0028	0.0964	0.0342
W4/F11	0.0097	0.3398	0.0577
W5	0.0057	0.1267	0.0223
W6	0.0070	0.1169	0.0322
W7	0.0076	0.0939	0.0417
D3	0.0047	0.1217	0.0247
D4	0.0059	0.1542	0.0576
D5/F4	0.0000	0.0553	0.0615
G17	0.0032	0.0653	0.0272
G18/F1	0.0074	0.1262	0.0471
G19	0.0024	0.0704	0.0408
G20	0.0042	0.0807	0.0320
G21	0.0020	0.1126	0.0566
G22	0.0187	0.2497	0.1532

5.0 Ritual differentiation within the Erlitou household sample

5.1 Pattern of the variable correlated to ritual in the two-dimensional configuration

This chapter will explore the patterning of the single household assemblage variable related to ritual differentiation in the two-dimensional multidimensional scaling configuration presented in Chapter 2. This is *Variable 14 – Ritual paraphernalia*.

Figure 5.1 is the two-dimensional configuration plot showing the relative values of Variable 14 – Ritual paraphernalia (Table 5.1). Each square in this figure represents the ratio of the number of items of ritual paraphernalia divided by the number of sherds of identifiable vessel forms in one household unit. Larger squares represent household units with higher proportions of ritual paraphernalia. In this plot, about 18 households were found with ritual paraphernalia, in proportions ranging from around 0.04% to around 0.67%. This proportion is quite small, and varies in quite a small range.

The ratio of 0.04% means about one ritual paraphernalia per 2500 sherds of identifiable vessel forms. If this is a true low rate for variable 14, the household units with only hundreds of sherds of identifiable vessel forms and no ritual paraphernalia are possibly the result of the large amount of random noise in small samples. Thus, the effects of zero results and small sample size must be taken into consideration carefully. The median of the ratios (the number of items of ritual paraphernalia divided by the number of sherds of identifiable vessel forms of each household unit) among the household units found with ritual paraphernalia is 0.1%. This means that there is probably one or more items of ritual paraphernalia per 1000 sherds of identifiable vessel forms. Thus, those household units with a sample size less than 1000 sherds of identifiable vessel forms

will be considered less reliable than those cases represented by a larger sample size. In figure 5.1, these less reliable cases are displayed in grey.

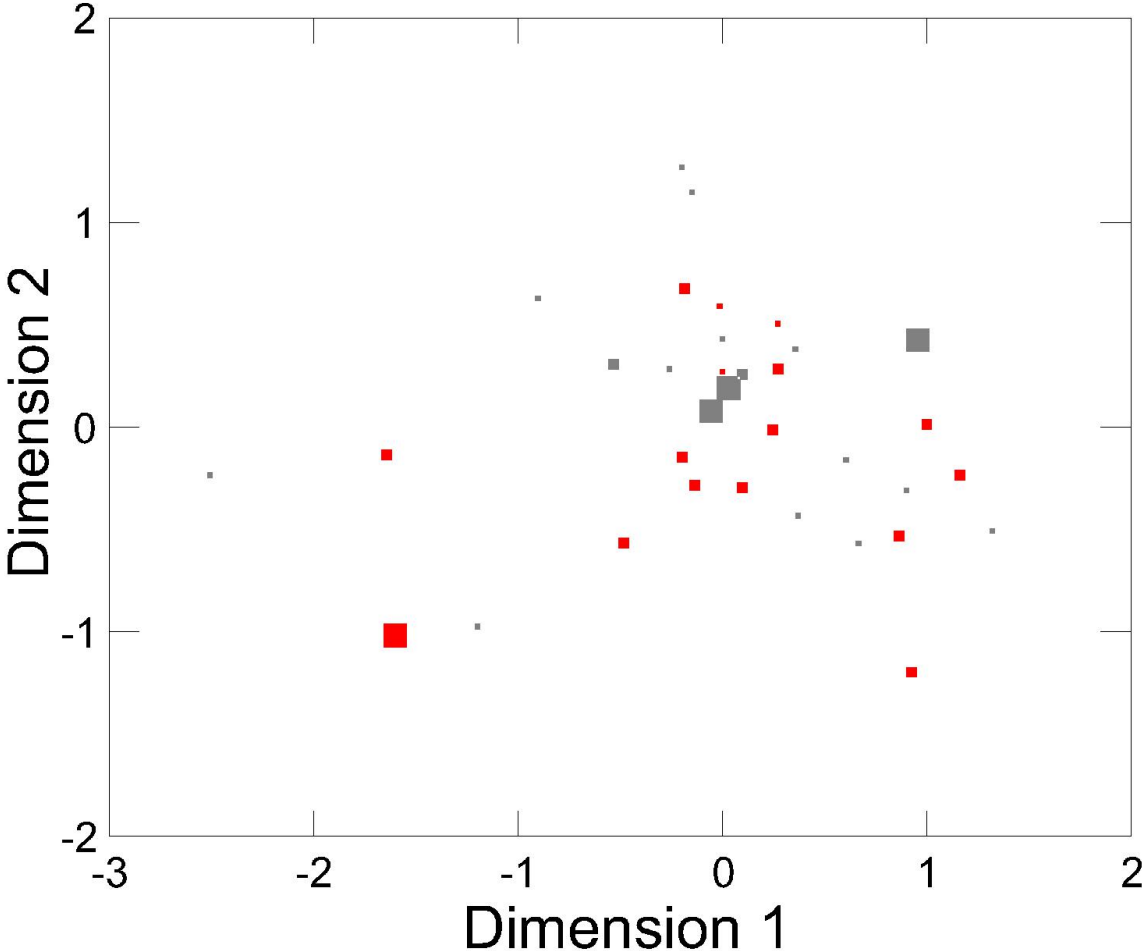


Figure 5.1 Plot of Variable 14 – Ritual paraphernalia (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

5.2 Discussion

Religious activities are believed to be monopolized by the elites in the early phase of state formation in China (Wang, Z. 2006; Chang 1989). Elites were specialized in communication with ancestors and gods and heavenly worship, through which they maintained their sovereign and stabilized their political hierarchy. According to the burial data, the Erlitou elites consumed very high-quality ritual paraphernalia in jade, turquoise, bronze, and lacquerwares (Cai 2006; Deng 2017; Yan 2020; Gao 2022; Ye and Li 2001; Xu 2016b). Bronze plaques inlaid with turquoise sheets, including the dragon-shaped turquoise artifact, are believed to be exclusive elite ritual paraphernalia (Cai 2006; Ye and Li 2001; Xu 2016b; Gao 2022). The animal patterns formed by the bronzes and turquoises probably enabled the ruling elites to communicate with the gods and supernatural spirits. In conjunction with musical instruments, like bronze bells and lacquer drums, Erlitou elites or specialized elite shamans may dance with these bronze-turquoise ritual paraphernalia in their hands to please the ancestors and supernatural spirits in exchange for prosperity and happiness (Cai 2006; Du 2006; He 2018; Gao 2022). Jade in animal shapes and other non-utilitarian forms have been argued to be ritual jades (玉祭器) which have served as proxies in communicating and worshiping gods and other supernatural spirits during religious or sacrificial activities since Neolithic China, and some jades in practical forms, which are believed to be ceremonial jades (玉瑞器), may serve as symbols of social status and complement rituals (Deng 2017, 2021). For example, lacquer cups (*gu* 觚) and handle-like jades (柄形器) may be used together to perform *Guan ritual* (裸礼), toasting to gods and supernatural spirits in religious activities and other sacrifices (Yan 2020). Jade serrated blades (*yazhang* 牙璋), which are in a practical-tool form and could have sharp blades, may complement worshiping gods and praying

for good harvests by offering ritual killing and blood (Wang 2002; Deng 2021). Such ritual paraphernalia in luxury raw materials and plenty of forms demonstrate that the Erlitou elites were engaged in multiple types of ritual activities beyond oracle divination by scapulimancy. It was possibly true that some ritual activities were monopolized by the elites, and commoners were excluded from such ritual activities. The ruling elites' families of the Erlitou state, who are presumed to occupy the palaces inside of the palatial enclosure, and the intermediate elites are expected to be tremendously high ritual families who must have more capacity in engaging in ritual activities represented by large quantities of ritual paraphernalia.

There are 18 household units (including 5 less reliable cases) in this sample found with ritual paraphernalia. The ritual paraphernalia seen in this household sample are entirely oracle bones except for one ceramic hollow-bottomed vessel (透底器). Although the function of the hollow-bottomed vessel is unknown, the ritual activities among the household units in this sample are almost entirely oracle divination by scapulimancy. Thus, compared to elite access to many different types of ritual activities and to luxury and high-quality ritual paraphernalia, the household units in this sample must share a pretty low rank on the ritual scale, almost certainly below what would be expected of "intermediate elites" and would be entirely outside the realm of the truly impressive ritual status of Erlitou elites.

As figure 5.1 shows, there is also no clear tendency of the ritual paraphernalia running from low to higher, but a relatively random scattering pattern. The household units with more ritual paraphernalia and the household units with less or even no ritual paraphernalia are thoroughly mixed with each other, showing no tendency to increase in engagement in ritual activities represented by the proportion of ritual paraphernalia in some particular direction, unlike wealth differentiation and prestige differentiation. If the ritual activities in the household units vary much

but gradually, the ratio of the ritual paraphernalia would form a tendency, starting from a low value in a part of the two-dimensional configuration and rising up to a higher value in another part of the configuration. Or even if it does not form a tendency or other spatial pattern in the scaling configuration, the ratio should vary substantially more than the most reliable samples indicate that it does. However, the figure 5.1 shows that some household units with more ritual paraphernalia stand in the lower left part and in the upper right part of this two-dimensional configuration, the cases with relatively moderate level of ritual paraphernalia stand in the upper left and the lower right of this two-dimensional configuration and those zeros scatter in the middle of the relatively largest and moderate proportions. The household units with the ritual paraphernalia are not only in or near the palatial enclosure, but also in or near the workshop enclosure and in the east end of the site although the cases from the workshop enclosure and the east end of site are quite small. In the meantime, only two household units with no items of ritual paraphernalia are represented by large enough samples to be pretty reliable, while most of household units with high values and those without any ritual paraphernalia are represented by small less reliable samples. Such patterning indicates that the access to ritual paraphernalia and ritual activities in this household sample did not vary much across the household units, and the household units in this sample had an even but quite modest access to certain ritual paraphernalia. So, these commoner households only participated in scapulimancy to a similarly small extent, and ritual activities or duties seem not to make up an important part of the differentiation among them.

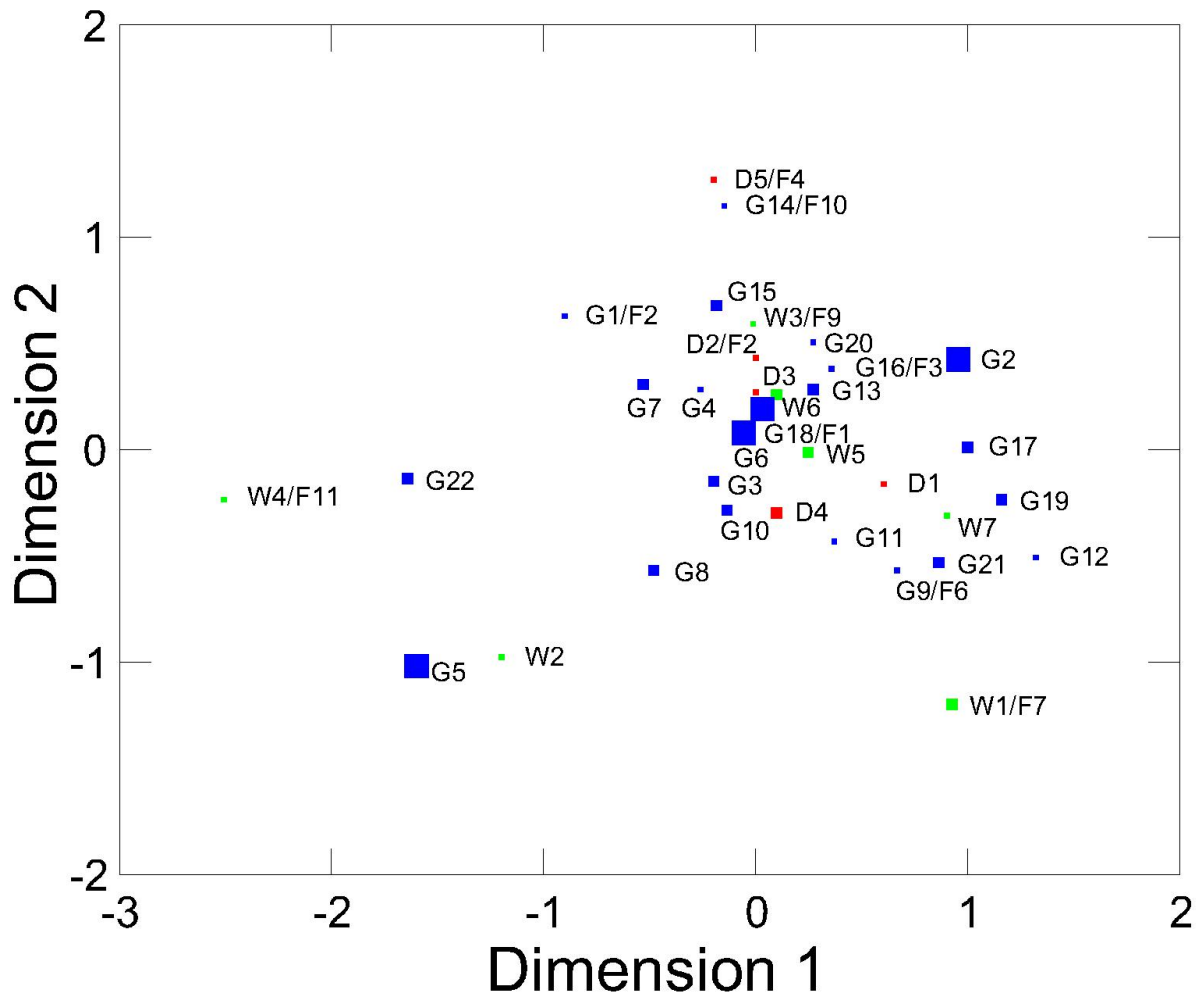


Figure 5.2 Household units indicating the proportions of ritual paraphernalia from different regions in different colors

(Larger squares represent higher ratios of ritual paraphernalia; Household units in or near the palatial enclosure in blue, household units in or near the workshop enclosure in green, and household units in the east end of the site in red)

Almost all these household units had a modest opportunity to access the divination by scapulimancy and were differentiated very little in ritual activities and status. The consumption of oracle divination by the commoner families indicates that scapulimancy was not the exclusive prerogative of top elites, although ritual paraphernalia (the consumed oracle bones) were not abundant in the commoner household units in this sample during the Erlitou period. This echoes

recent findings from the Shang period that scapulimancy was shared by the royal elites and non-royal families during the Bronze Age so that both royal elites and commoners could communicate with spirits and ancestors through pyromancy (Poo 1998; Pu 2007). Thus, the ritual activities, at least oracle divination by scapulimancy, were also probably shared by the royal elites and commoners in the Erlitou state, to some extent, and the Erlitou commoners had limited access to ritual activities, possibly only oracle divination by scapulimancy, based on the multidimensional scaling of the 34 household units and the quite low amount of ritual paraphernalia involving almost nothing more than oracle divination by scapulimancy.

Taking it from another point of view (Figure 5.2), if commoners were completely excluded from the palatial enclosure, we expect to see a clear gap in terms of ritual paraphernalia between the household units in or near the palatial enclosure and the household units from other locations, forming a cluster of oracle divination artifacts and activities composed of only household units within the palatial enclosure where the proportion of ritual paraphernalia representing access to ritual activities should be dramatically high. It is also expected that if commoners were excluded from the oracle divination, a cluster of no divination activities should be composed of all the commoner families from the workshop enclosure and the east end of the site in this sample. However, there is no clear clustering of different locations; there are some household units with ritual paraphernalia from the three locations mixed together thoroughly. On the other hand, the household units with the ritual paraphernalia in or near the palatial enclosure are far more than the other two locations; among the 18 household units found with ritual paraphernalia, some are in or near the palatial enclosure (14), some are from the workshop enclosure (3), and one is in the east end of the site (1). Meanwhile, even though the modest proportions of ritual paraphernalia are shared across the household units from the three locations, the four household units that consumed

the high proportions of ritual paraphernalia are all from the palatial enclosure, and more household units with medium (4) and low (6) proportions were in the palatial enclosure than in the workshop enclosure (2 medium and 1 low) and the east end of the site (1 low). In this sample, about 64% of the household units in or near the palatial enclosure have modest proportions of ritual items and about 18% have high proportions; Only about a third of the household units elsewhere (about 43% in or near the workshop enclosure and 20% in the east end of the site) have modest proportions but none have high proportions. So, being near the palaces is thus not the only way commoner households were able to participate in scapulimancy, but household units near the palaces were definitely more involved in this activity than other households were (in this sample at least). The household units with more access to oracle divination by scapulimancy tended to be closer to the ruling elites. Some household units in the palatial enclosure were thus slightly more focused on divination in the hope of more auspicious futures than the household units from the other two locations. But the absence of evidence of storage of unused oracle bones (only used ones were found) suggests that all the household units in this sample regardless of their locations might still rely on professional diviners to practice and read the divination. Of the household units in or near the palatial enclosure who had modest access to oracle divination by scapulimancy, most (13) are near the No.2 and No. 4 palaces (Figure 1.4 and 1.5), which are thought to be royal ancestral temples (Du 2007a and 2007b). The commoner families from the palatial enclosure in this sample who had access to oracle divination by scapulimancy, although modest, tended to be close to these ancestral temples. This also suggests that probably the commoners' access to divination in this household sample was part of a relationship to the veneration of royal ancestors.

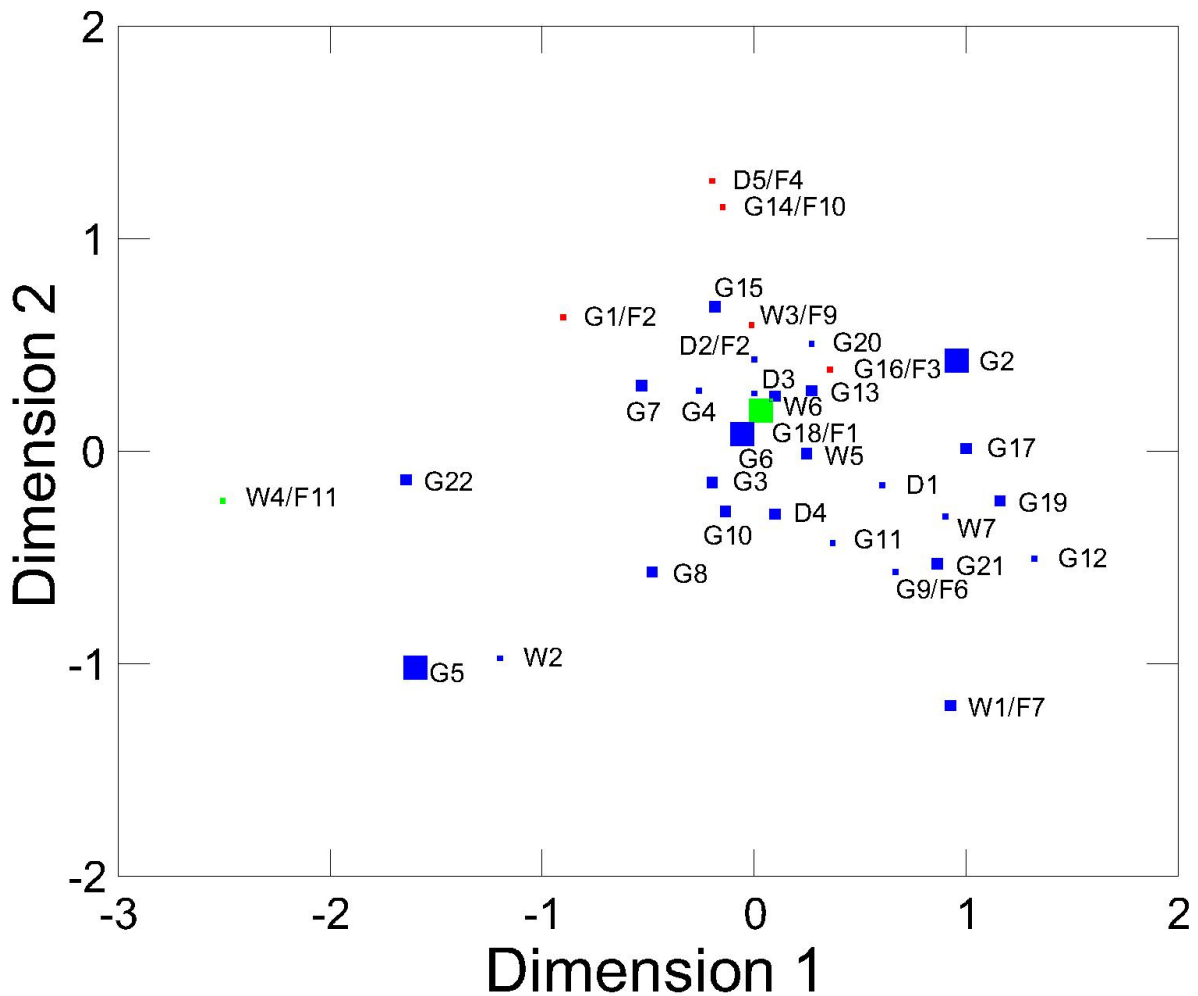


Figure 5.3 Household units indicating proportions of ritual paraphernalia colored by different housing structures

(Larger squares represent higher ratios of ritual paraphernalia; household units living in small above-ground structures in red, household units occupying semi-subterranean structures in green, household units with unknown structures in blue.)

On the other hand, figure 5.3 displays how the proportions of ritual paraphernalia behave across the household units with different housing structures. Only two household units with housing structures were found with ritual paraphernalia; one (G18/F1) lived in a semi-subterranean structure, and one (W1/F7) was in an unknown housing structure. Meanwhile, most of the household units living in the small above-ground housing structures and the semi-subterranean

housing structures found with no ritual paraphernalia and the one living in a semi-subterranean housing structure (G18/F1) with modest access to ritual activities are represented by small less reliable samples. Thus, the only structure with ritual paraphernalia whose type we know was semi-subterranean. But this one observation is not sufficient to sustain conclusions about how the ritual differentiation occurred among the commoner families living in clear identifiable housing types in this sample.

Table 5.1 The proportions of ritual paraphernalia divided by the number of sherds of identifiable vessel forms in the 34 household units

Household unit	Ritual paraphernalia
G1/F2	0.0000
G2	0.0050
G3	0.0019
G4	0.0000
G5	0.0020
G6	0.0067
G7	0.0011
G8	0.0004
G9/F6	0.0000
G10	0.0008
W1/F7	0.0008
W2	0.0000
D1	0.0000
D2/F2	0.0000
G11	0.0000
G12	0.0000
G13	0.0012
G14/F10	0.0000
G15	0.0015
G16/F3	0.0000
W3/F9	0.0000
W4/F11	0.0000
W5	0.0013
W6	0.0012
W7	0.0000
D3	0.0000
D4	0.0004
D5/F4	0.0000
G17	0.0006
G18/F1	0.0030
G19	0.0004
G20	0.0000
G21	0.0009
G22	0.0009

6.0 Productive differentiation within the Erlitou household sample

6.1 Patterns of the variables correlated to production in the two-dimensional configuration

This chapter will explore the patterning of household assemblage variables related to productive differentiation in the two-dimensional multidimensional scaling configuration presented in Chapter 2. Such variables are *Variable 8 – Carpentry/construction tools*, *Variable 9 – Agricultural tools*, *Variable 10 – Textile tools*, *Variable 11 – Weapons/hunting tools*, *Variable 12 – Resharpener tools*, *Variable 13 – Fishing tools*, *Variable 15 – Lithic production*, *Variable 16 – Bone production*, *Variable 17 – Antler production*, *Variable 18 – Shell production and Variable 19 – Bronze working*.

6.1.1 Variable 9 – Agricultural tools

Figure 6.1 is the two-dimensional configuration plot showing the 34 household units in this sample indicating the values of Variable 9 – agricultural tools. Each square in this plot represents the ratio of the number of agricultural tools divided by the number of sherds of identifiable vessel forms in a household unit (Table 6.1). Larger squares represent household units with larger proportion of agricultural tools, indicating a larger involvement in agricultural activities. In this plot, 23 household units were found with agricultural tools, in proportions ranging from about 0.04% to about 0.70%.

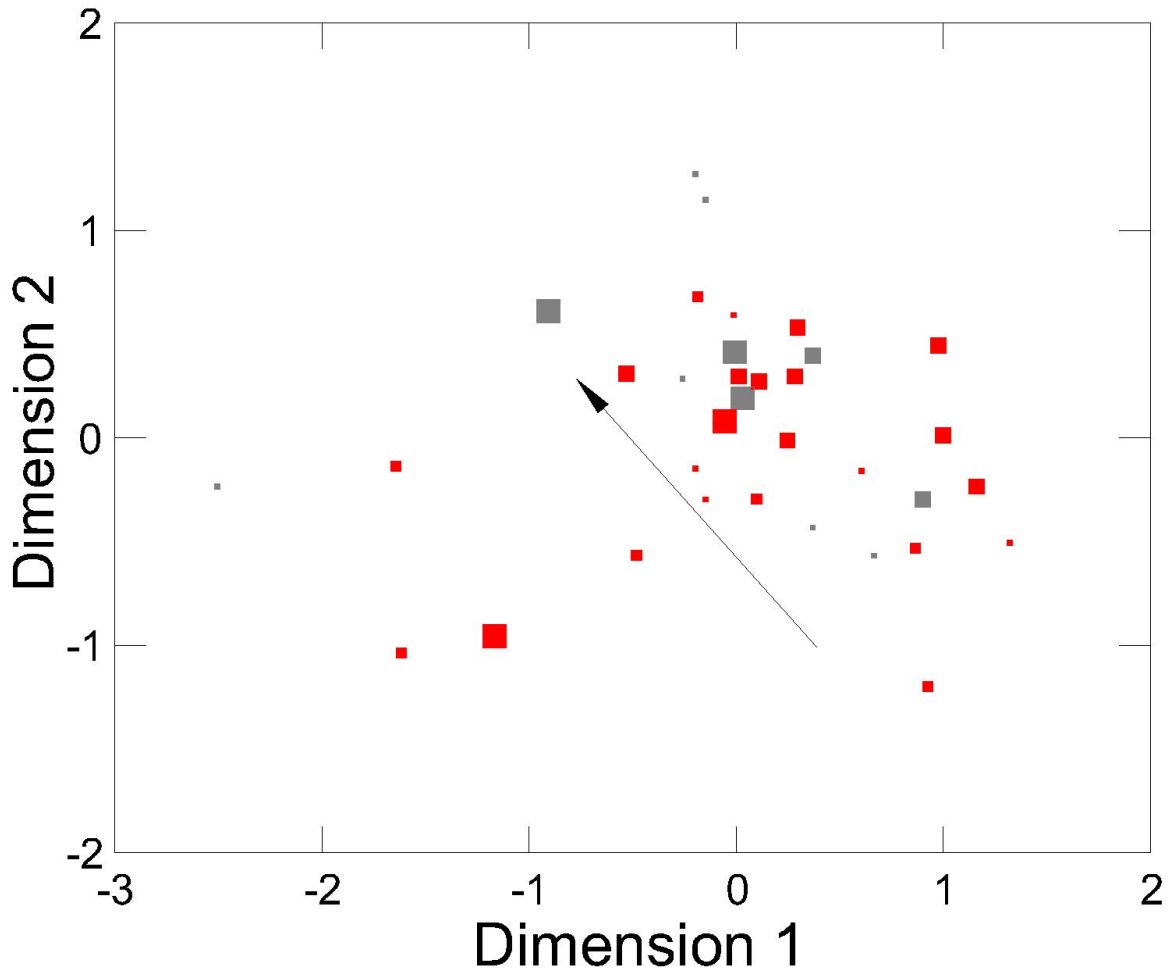


Figure 6.1 Variable 9 – Agricultural tools (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 500 sherds of various vessel forms)

The ratio of 0.04% means about one agricultural tool per 2500 sherds of identifiable vessel forms in one household unit. If this is a true low rate for variable 9, the household units with only hundreds of sherds of identifiable vessel forms and no agricultural tools are possibly the result of the large amount of random noise in small samples. Thus, the effects of zero results and small samples must be taken into consideration carefully. The median of the ratios of agricultural tools among the household units found with agricultural tools is about 0.2%, meaning that there could be one or more agricultural tools per 500 sherds of identifiable vessel forms in a household unit.

Thus, household units with sample sizes of less than 500 sherds of identifiable vessel forms would be less reliable than those represented by a larger sample. In figure 6.1, these less reliable cases are displayed in grey.

There are 23 household units (including 5 less reliable cases) in this sample found with agricultural tools. The variation of the proportion of agricultural tools shows a relatively gradual tendency, starting from fairly low proportions at the lower right and rising toward the upper left part of the two-dimensional plot. Such variation suggests that among the household units who participated in agricultural activities, those in the upper left part of the configuration space were more intensively focused on these activities. Chapter 3 established that wealth among the commoner families in this sample also increases gradually towards the upper left of the configuration space. Thus, figure 6.1 shows that household units more intensively involved in agricultural production tended strongly to be more wealthy than other households in this sample. On the other hand, not all the households in the wealthier corner of the configuration plot were much involved in agricultural production. Such patterning suggests that some household units might have increased their wealth by focusing on agricultural production, but this is not the only way by which household units could increase their wealth in this sample.

6.1.2 Variable 8 – Carpentry/construction tools

Figure 6.2 is the two-dimensional configuration plot showing the 34 household units in this sample indicating the values of Variable 8 – Carpentry/construction tools. Each square in this figure represents a ratio of the number of carpentry/construction tools divided by the number of sherds of identifiable vessel forms in each household unit (Table 6.1). Larger squares represent household units with larger proportions of carpentry/construction tools, indicating a larger

involvement in carpentry or construction activities. In this plot, 19 household units were found with carpentry/construction tools, in proportions ranging from around 0.05% to around 1.22%.

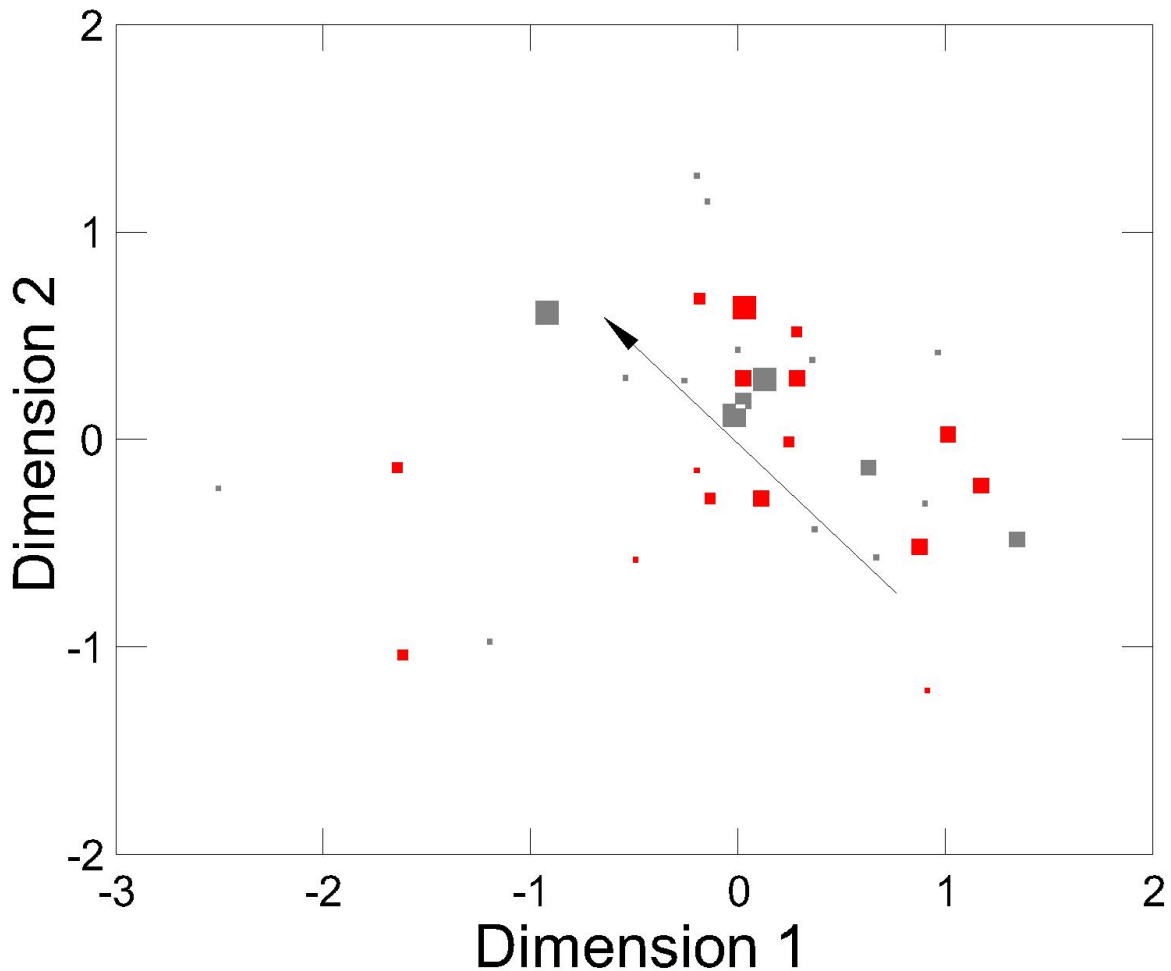


Figure 6.2 Variable 8 – Carpentry/construction tools (as a proportion in sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

The ratio of 0.05% means about one carpentry/construction tool per 2000 sherds of identifiable vessel forms in a household unit. If this is a true low rate for variable 8, the household units with only hundreds of sherds of identifiable vessel forms and no carpentry/construction tools are possibly the result of the large amount of random noise in small samples. The effects of zero results and small samples must be taken into consideration carefully. The median of the ratios of

carpentry/construction tools among the household units found with carpentry/construction tools is about 0.1%. This means that probably there is one or more carpentry/construction tools per 1000 sherds of identifiable vessel forms. Thus, those household units with a sample size less than 1000 sherds of identifiable vessel forms should be counted as less reliable than those cases represented by a larger sample size. In figure 6.2, these less reliable cases are displayed in grey.

There are 19 household units (including 6 less reliable cases) found with carpentry/construction tools. There is no sharp division shown in this two-dimensional plot, but a gradual variation starting from fairly low proportions of carpentry/construction tools in the lower right, rising moderately in the middle and then reaching the highest values at the upper left of the two-dimensional configuration. Among the household units involved in carpentry or construction activities, those who focused more on this carpentry or construction activities tend to appear in the upper left where chapter 3 established that the wealthier households in this sample are. As with agricultural production, some households seem to have increased their wealth through carpentry or construction activities, but this was not the only means of increasing wealth because some of the wealthier households were not much involved in carpentry or construction activities.

6.1.3 Variable 11 – Weapons/hunting tools

The two-dimensional plot indicating the values of Variable 11 – Weapons/hunting tools (Figure 6.3) displays how the proportions of weapons/hunting tools (divided by the number of sherds of identifiable vessel forms in each household unit in this sample) behave. Each square represents one household unit. Larger squares represent household units with higher proportions of weapons/hunting tools. In this sample, there are 16 household units found with weapons/hunting tools, all with quite low proportions ranging from around 0.05% to around 1.10%; in other words,

the ratios range from about one weapon/hunting tool per 2000 sherds of identifiable vessel forms to about one weapon/hunting tool per 91 (Table 6.1).

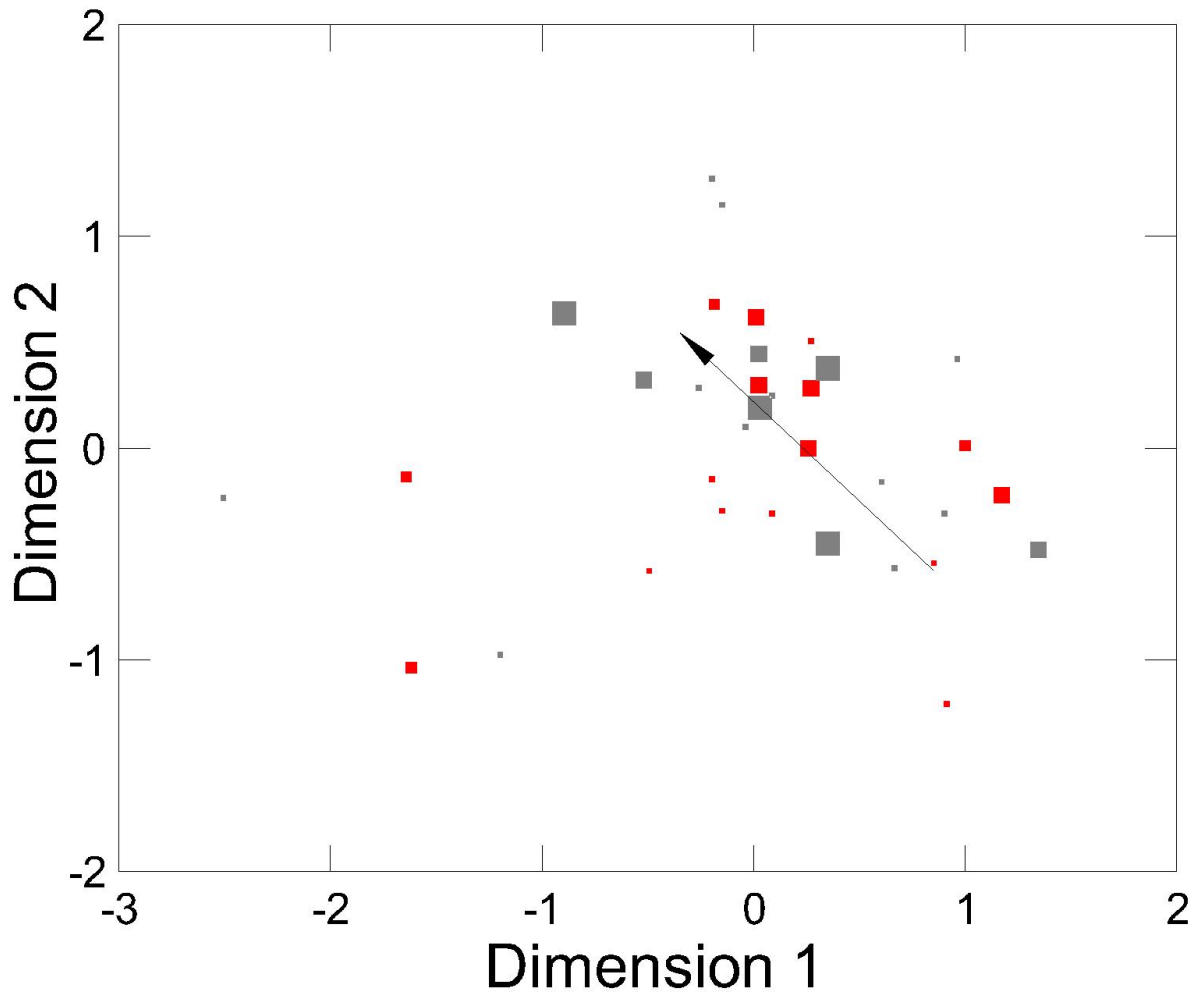


Figure 6.3 Variable 11 – Weapons/hunting tools (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

If the ratio, about one weapon/hunting tool per 2000 sherds of identifiable vessel forms, is truly low, then, we cannot say that the household units with only hundreds of sherds of identifiable vessel forms and no weapon/hunting tools really have a lower weapon/hunting tool ratio than the household unit with one weapon/hunting per 2000. The median of the ratios of weapons/hunting tools among the household units found with weapons/hunting tools is about 0.1%. Then household

units with a sample of sherds of identifiable vessel forms less than 1000 should be counted as less reliable than those represented by a larger sample size. These less reliable cases are colored grey in figure 6.3.

There are 16 household units (including 7 less reliable cases) found with weapons/hunting tools. The proportions from these household units form a gradual tendency, increasing from low values in the lower right to higher values in the upper left (wealthier) part of the two-dimensional configuration. Once again, some household units might have increased their wealth through military activities or hunting, but there were other ways for the commoner families in this sample to increase their wealth as well.

6.1.4 Variable 15 – Lithic production

Figure 6.4 is the two-dimensional configuration showing the 34 household units in this sample indicating the values of Variable 15 – lithic production. Each square in this plot represents a ratio of the number of lithic tool production remains divided by the number of sherds of identifiable vessel forms in a household unit. Larger squares represent household units with higher proportions of lithic tool production remains, indicating a larger engagement in lithic production. In this plot, 13 household units are found with lithic tool production remains, with proportions ranging from about 0.04% to about 1.22% (Table 6.1).

The ratio of 0.04% means that there is possibly one lithic tool production remain per 2500 sherds of identifiable vessel forms in a household unit. If this is a true low rate, then the household units with only hundreds of sherds of identifiable vessel forms and no lithic tool production remains are possibly the result of the large amount of random noise in small samples. The median of the ratios of lithic tool production remains among the household units found with lithic tool

production remains is about 0.1%, meaning that there could be one or more lithic tool production remains per 1000 sherds of identifiable vessel forms. Thus, the household units with a sample size of sherds of identifiable vessel forms less than 1000 should be less reliable than those represented by a larger sample size. The less reliable cases are displayed in grey in figure 6.4.

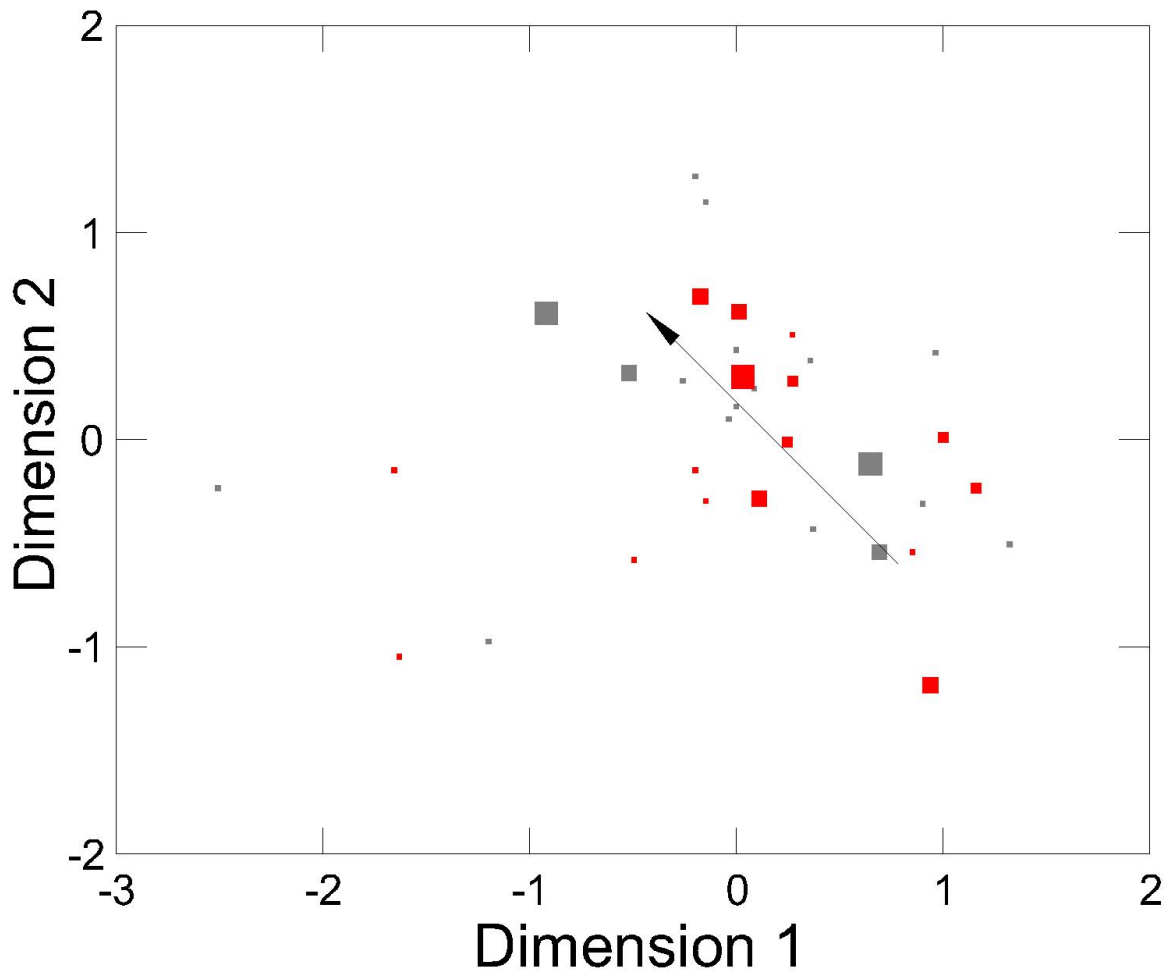


Figure 6.4 Variable 15 – Lithic production (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

The proportions of lithic tool production remains show a gradual tendency, rising from low proportions in the lower right to higher proportions in the upper left part of the two-dimensional plot. This suggests that the household units that were more involved in lithic tool production tend

to stand in the upper left (wealthier) part of this plot. However, there are still some household units in the wealthy area in the scaling space that do not have higher proportions of lithic tool production. Such patterning once again suggests that some commoner families in this sample might have accumulated wealth through a focus on lithic tool production while other commoner families accumulated wealth through a focus on some other productive activities.

6.1.5 Variable 16 – Bone production

The two-dimensional configuration indicating the values of Variable 16 – bone production (Figure 6.5) shows how the proportions of the number of bone artifact production remains divided by the number of sherds of identifiable vessel forms in this household sample behave. A larger square represents a household unit with a larger proportion of bone artifact production remains. In this sample, 15 household units were found with bone artifact production remains, with quite low rates ranging from about 0.06% to about 0.61%; in other words, the ratios range from about one bone artifact production remain per 1667 sherds of identifiable vessel forms to about one bone artifact production remain per 164 sherds of identifiable vessel forms (Table 6.1).

If one bone artifact production remain per 1667 sherds of identifiable vessel forms is truly a low rate, then the household units with only hundreds of sherds of identifiable vessel forms and no bone artifact production remains cannot be said confidently to have a lower ratio than the household unit with one bone artifact production remain per 1667. The median of the ratios of bone artifact production remains among the household units found with bone artifact production remains is about 0.2%. Then, household units with a sample size of sherds of identifiable vessel forms less than 500 are less reliable than those represented by a larger sample size. These less reliable cases are displayed in grey in figure 6.5.

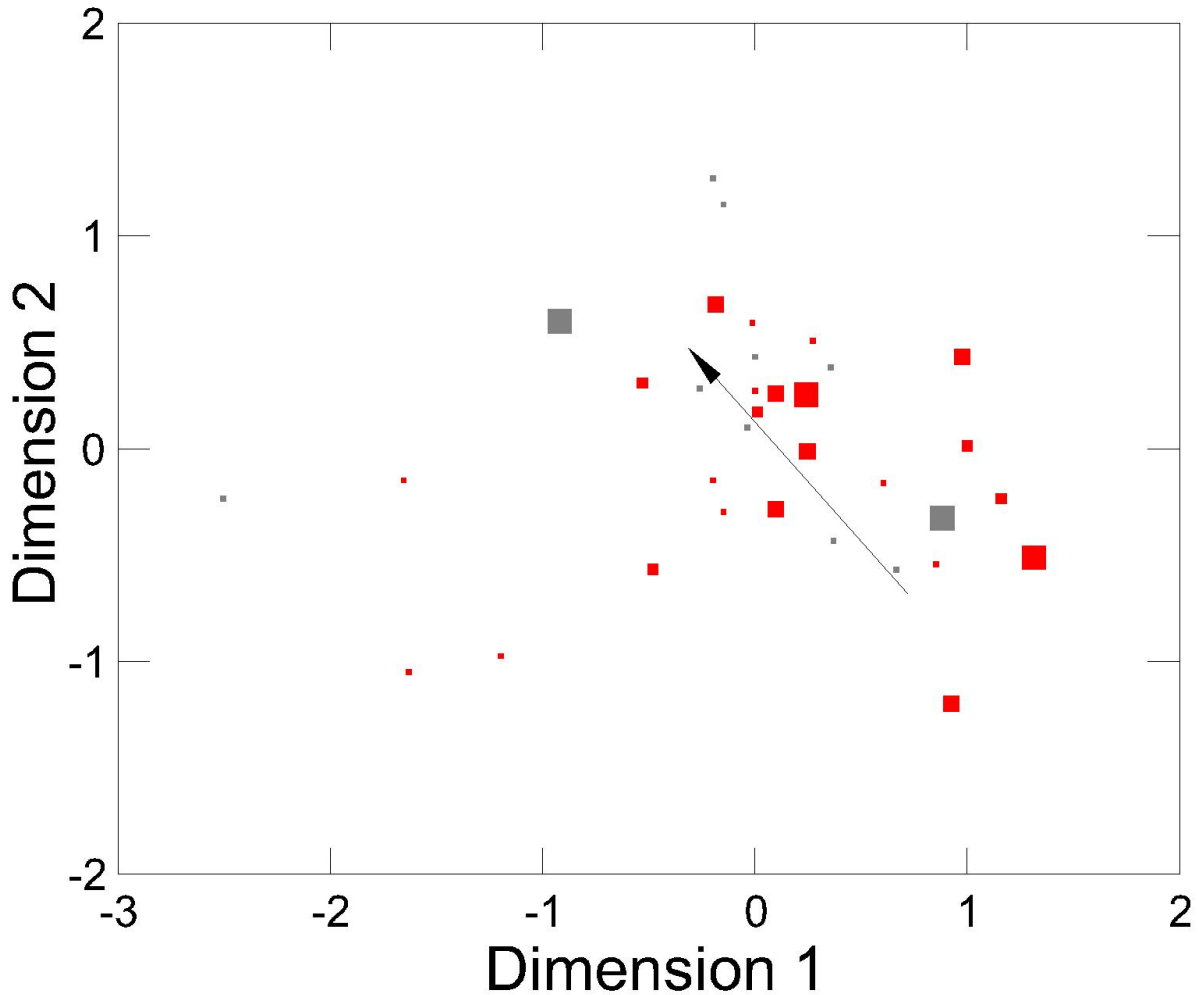


Figure 6.5 Variable 16 – Bone production (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 500 sherds of various vessel forms)

There are 15 household units (including 2 less reliable cases) found with bone artifact production remains. The proportions of these household units behave in a gradual way, starting from low proportions in the lower right and climbing up to higher proportions in the upper left part of the two-dimensional plot. Household units more involved in bone artifact production tend to stand in the upper left (wealthier) part of this plot. This suggests that some household units in this sample might have accumulated wealth through bone artifact production, but some other household units could also accumulate wealth through a focus on other productive activities.

6.1.6 Variable 17 – Antler production

Figure 6.6 is the two-dimensional configuration indicating the values of the variable of antler production showing how the proportions (of the number of antler artifact production remains divided by the number of sherds of identifiable vessel forms of each household unit) behave in this sample. Each square in the plot represents a household unit with antler artifact production remains, and larger squares indicate higher proportions of antler artifact production remains. Only 8 household units in this sample were found with antler artifact production remains. The proportions of antler artifact production remains are quite low, ranging from about 0.07% to about 1.22% (Table 6.1).

The ratio of 0.07% means that there possibly is one antler artifact production remain per 1429 sherds of identifiable vessel forms. If this is a true low rate for variable 17, the household units with only hundreds of sherds of identifiable vessel forms and no antler artifact production remains are possible results of the large amount of random noise in small samples. The median of the ratios of antler artifact production remains among the household units found with antler artifact production remains is about 0.1%. The household units with a sample size of sherds of identifiable vessel forms less than 1000 are less reliable cases than those represented by a larger sample size. The less reliable cases are displayed in grey in figure 6.6.

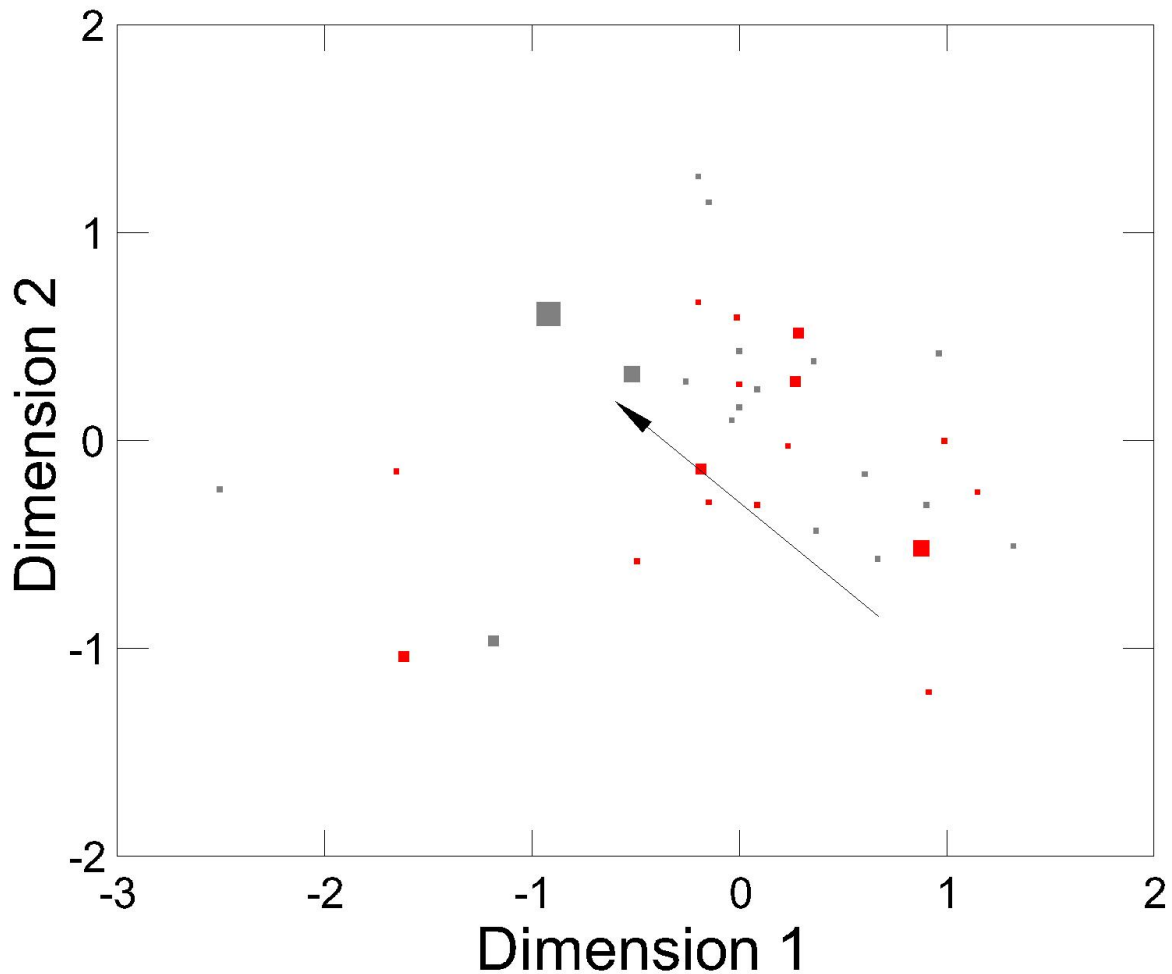


Figure 6.6 Variable 17 – Antler production (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

There are only 8 household units (including 3 less reliable cases) uncovered with antler artifact production remains. Such a small sample size suggests that the antler artifact production was not an important economic activity widely engaged in by the household sample, and only a few families were specialized in the antler artifact production. The proportions of antler artifact production remains also do not form a clear cluster, but show a relatively gradual tendency starting with low proportions in the lower right and rising toward the upper left of the two-dimensional plot. Some household units that were more involved in antler artifact production tend to appear in

the upper left (wealthier) part of the configuration space. Such variation suggests that some household units in this sample could accumulate some wealth through emphasizing the antler artifact production, but there were still some other ways for the commoner families to increase wealth.

6.1.7 Variable 19 – Bronze working

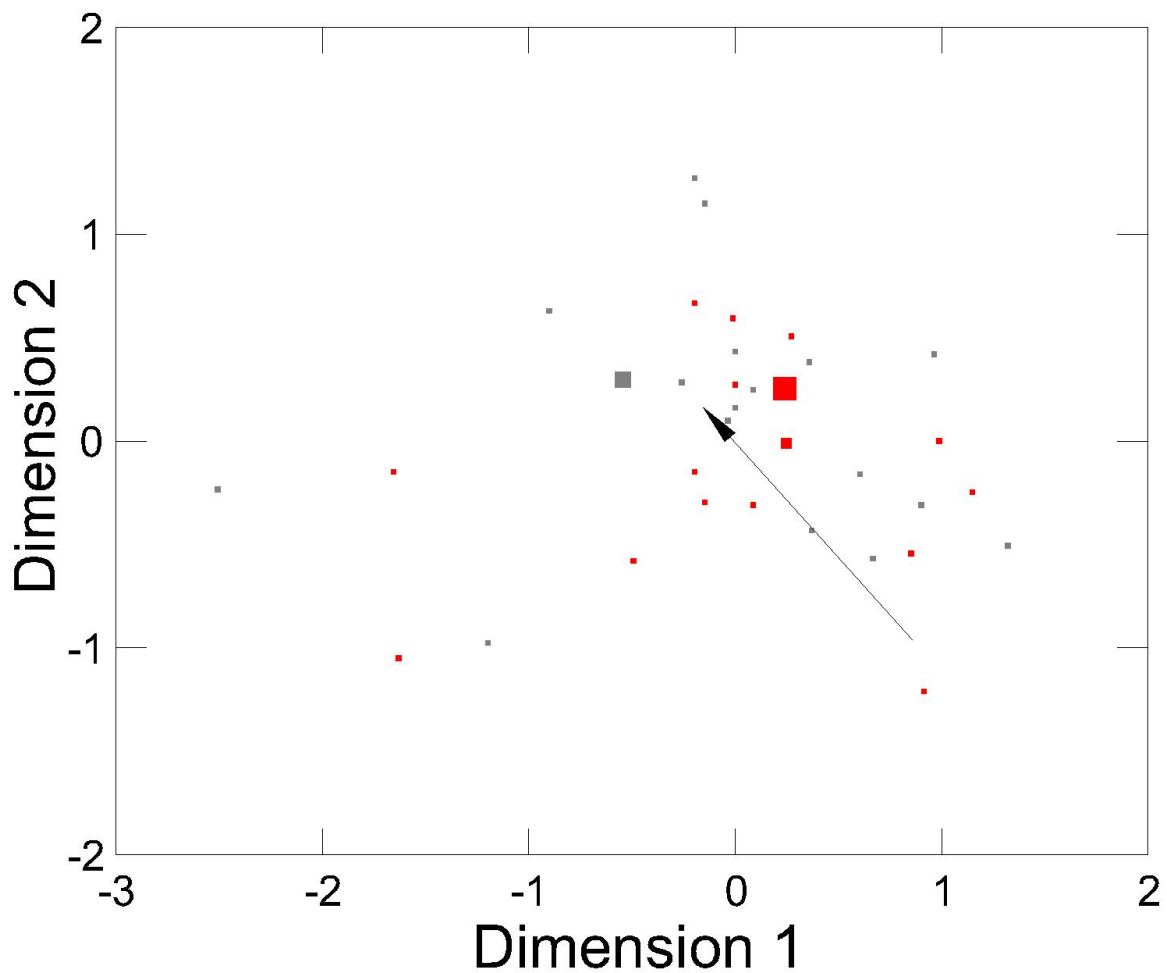


Figure 6.7 Variable 19 – Bronze working (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

Figure 6.7 is the two-dimensional configuration plot showing the 34 household units in this sample indicating the values of variable 19 – bronze working. Each square in this figure represents the ratio of the number of copper ores and slags divided by the number of sherds of identifiable vessel forms in a household unit. Larger squares represent household units with larger proportions of bronze working remains, indicating a larger involvement in bronze working. In this plot, only 3 household units were found with copper ores and/or slags, with proportions of around 0.03%, 0.11% and 0.24% (Table 6.1).

The ratio of 0.03% means that there is possibly one bronze working remain per 3333 sherds of identifiable vessel forms in a household unit. If this is a true low rate, the household units with only hundreds of sherds of identifiable vessel forms and no bronze working remains are possible results of the large amount of random noise in small samples. Given the effects of small sample size and zero results, this study also investigates the median of the ratios of bronze working remains among the household units found with bronze working remains. This median is about 0.1%. Thus, the household units with a sample size of sherds of identifiable vessel forms less than 1000 are counted as less reliable and displayed in grey in figure 6.7.

Bronze working also raises more complicated issues to consider than the productive activities discussed above. There are only 3 household units (including 1 less reliable case) found with bronze working remains. Bronze smelting and casting is believed to be a much more complex productive activity than other household-based production and is usually thought to require high-level specialization and workshop-based production. It requires a large and stable supply of ores, furnaces, and other equipment. A bronze-casting workshop has been identified in the southern part of the workshop enclosure. The bronze-casting workshop has been argued as a royal-controlled elite-oriented production only supply for the elite consumption of the bronze items (Zhongguo

1999, 2003, and 2014; Chen 2016; Liu and Chen 2003; Xu 2009 and 2022). An array of bronze casting remains including crucibles, ores, slags, lithic and pottery molds, and furnaces have been found in the area of the bronze-casting workshop suggesting that the bronze casting was specialized in that area (Zhongguo 1999; Chen 2016). However, some copper ores and slags are found associated with household garbage. Such small amounts of material related to some part of bronze working and no other equipment make us wonder whether such remains from somewhere else might simply have been incorporated into the household garbage rather than representing an activity actually carried out at these households. If these copper ores and slags were from somewhere else that conducted bronze-smelting (or, even -casting), for them to become incorporated into household garbage would suggest bronze-working near the household units in whose garbage they wound up. But, of the three household units with bronze-working remains, two (G7 and G13) are in the palatial enclosure, and one (W5) is in the northern part of the workshop enclosure (which is currently known as the turquoise workshop). None of the three is in the vicinity of the bronze-casting workshop which is in the southern part of the workshop enclosure. Before 1999 - 2006, some bronze-working remains including crucibles, slags, and ceramic molds dating to Erlitou Phase 2 had been found both at the northeast of the palatial enclosure and in the area of the later bronze-casting workshop, suggesting that bronze-smelting (or -casting) were possibly conducted in more than one place but closer to the ruling elites before Erlitou Phase 3 by which bronze casting became concentrated in the bronze-casting workshop in the workshop enclosure (Zhongguo 1999; Chen 2016). In Erlitou Phase 4, copper ores and slags began to be seen outside of the bronze-casting workshop again suggesting that there might be some other smelting or casting spots in the Erlitou site simultaneous with the specialized bronze-casting workshop (Zhongguo 2014; Chen 2016). Based on the small amount of bronze-working remains, Chen

(2016) argues there might be small-size smelting or casting spots serving for some less complex bronze item production or for mending broken bronze items. Although it is strange to conduct bronze working in a household context, for now the possibility of household-level bronze-working to serve the ruling elites cannot be ruled out for sure.

If the copper ores and slags found in the household garbage truly represent household-level bronze working activities, it suggests that bronze working was not an important economic activity widely engaged in by the household sample, being even less widespread than antler artifact production. In this case, only a few families were specialized in bronze working, and the commoner families who were specialized in bronze working activities were likely to be in the moderate level of wealth accumulation.

6.1.8 Discussion of productive activities related to greater wealth

Variable 8 – carpentry/construction tools, variable 9 – agricultural tools, variable 11 – weapons/hunting tools, variable 15 – lithic production, variable 16 – bone production, and variable 17 – antler production pattern in a relatively similar way in the space defined by the two-dimensional configuration. The six variables all vary gradually, running from lower proportions in the lower right to higher proportions in the upper left of the plot of Dimensions 1 and 2. The household units with high proportions of carpentry/construction tools, agricultural tools, weapons or hunting tools, lithic tool production remains, bone artifact production remains, antler artifact production remains tend to stand in the upper left (wealthier) part of the plot. Most of the household units in the wealthier zone of the scaling space have a focus on one or another, or even more than just one, of these six productive activities. This pattern suggests that household units could accumulate wealth by intensifying their participation in carpentry or construction activities,

agricultural activities, military or hunting activities, lithic tool production, bone artifact production, or antler artifact production, and that such economic activities were likely to offer good economic returns.

6.1.9 Variable 12 – Resharpener tools

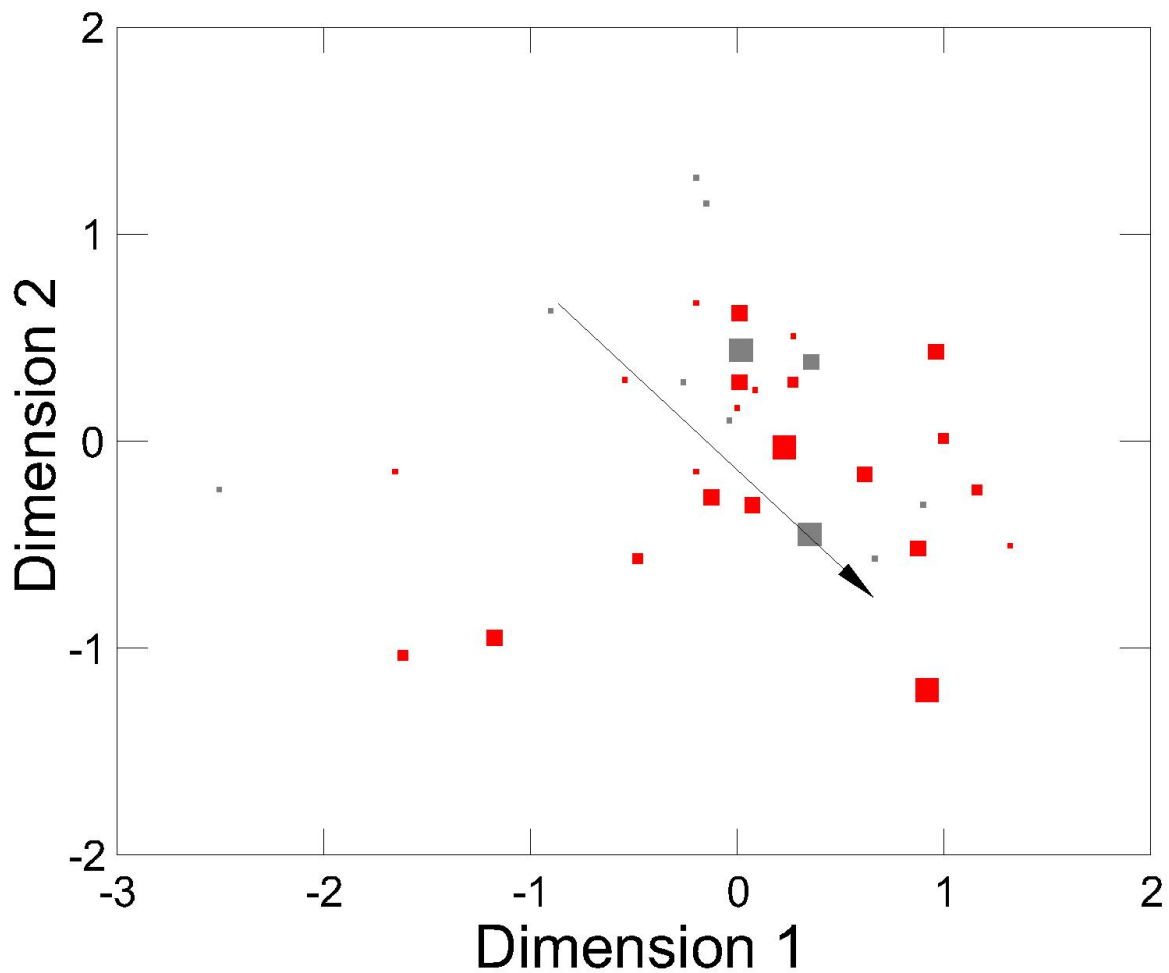


Figure 6.8 Variable 12 – Resharpener tools (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 500 sherds of various vessel forms)

The two-dimensional plot indicating the values of Variable 12 – resharpening tools (Figure 6.8) reveals how the proportions of the number of resharpening tools divided by the number of sherds of identifiable vessel forms of each household unit in this sample behave. Larger squares represent household units with larger proportions of the resharpening tools, or whetstones. In this sample, resharpening tools are extremely rare, in proportions ranging from only about 0.04% to about 0.55% (Table 6.1). Such ratios range from about one whetstone per 2500 sherds of identifiable vessel forms to about one whetstone per 182 sherds of identifiable vessel forms.

If the ratio of one whetstone per 2500 sherds of identifiable vessel forms in one household unit is a true low rate, we cannot say confidently a household unit with only hundreds of sherds of identifiable vessel forms and no whetstone really has a lower resharpening tool ratio than the household unit with one whetstone per 2500 sherds of identifiable vessel forms. Considering the effects caused by zero values for resharpening tools and small sample size, this study takes a further look at the resharpening tool ratios among the household units found with whetstones and finds the median of the ratios is about 0.2%. Such a ratio means that we could expect one or more whetstone if the number of sherds of identifiable vessel forms is greater than 500. So, when no whetstones are found for household units with a sample of fewer than 500 sherds of identifiable vessel forms, it is uncomfortably likely that the zero results may only be the result of the large amount of random noise in small samples. Therefore, the household units with a sample size of sherds of identifiable vessel forms less than 500 are possibly less reliable cases and displayed in grey in figure 6.8.

There are 18 household units (including 3 less reliable cases) found with whetstones or resharpening tools. The variation in the proportions of resharpening tools is relatively gradual, starting from fairly low proportions at the upper left and increasing toward the lower right part of

the two-dimensional plot. So, the household units who consumed more resharpening tools and were more engaged in resharpening or smoothing services tend to be in the middle to the lower right part of the plot. Referring to the wealth tendency, the household units who were more involved in the resharpening or smoothing activities are in the middle to lower ranges of the wealth distribution. Such patterning suggests that resharpening or smoothing, in contrast to the productive activities considered above, was not an activity representing a pathway towards greater wealth for the commoner families in this household sample.

6.1.10 Variable 10 – Textile tools

Figure 6.9 is the two-dimensional configuration plot showing the 34 household units in this sample indicating the values of Variable 10 – textile tools. Each square in this figure represents a ratio of the number of textile tools divided by the number of sherds of identifiable vessel forms in a household unit. Larger squares represent household units with larger proportions of textile tools, indicating a larger involvement in textile activities. In this plot, there are 13 household units found with textile tools, in quite low proportions ranging from about 0.08% to about 0.67% (Table 6.1).

The rate of 0.08% means that there could be about one textile tool per 1250 sherds of identifiable vessel forms in a household unit. If this is a true low rate, then the household units with only hundreds of sherds and no textile tools are possibly the result of the large amount of random noise in small samples. The median of the ratios of textile tools among the household units found with textile tools is about 0.2%, indicating that there could be one or more textile tools per 500 sherds. Thus, the household units with a sample size of sherds of identifiable vessel forms less than 500 are considered less reliable and are colored grey in figure 6.9.

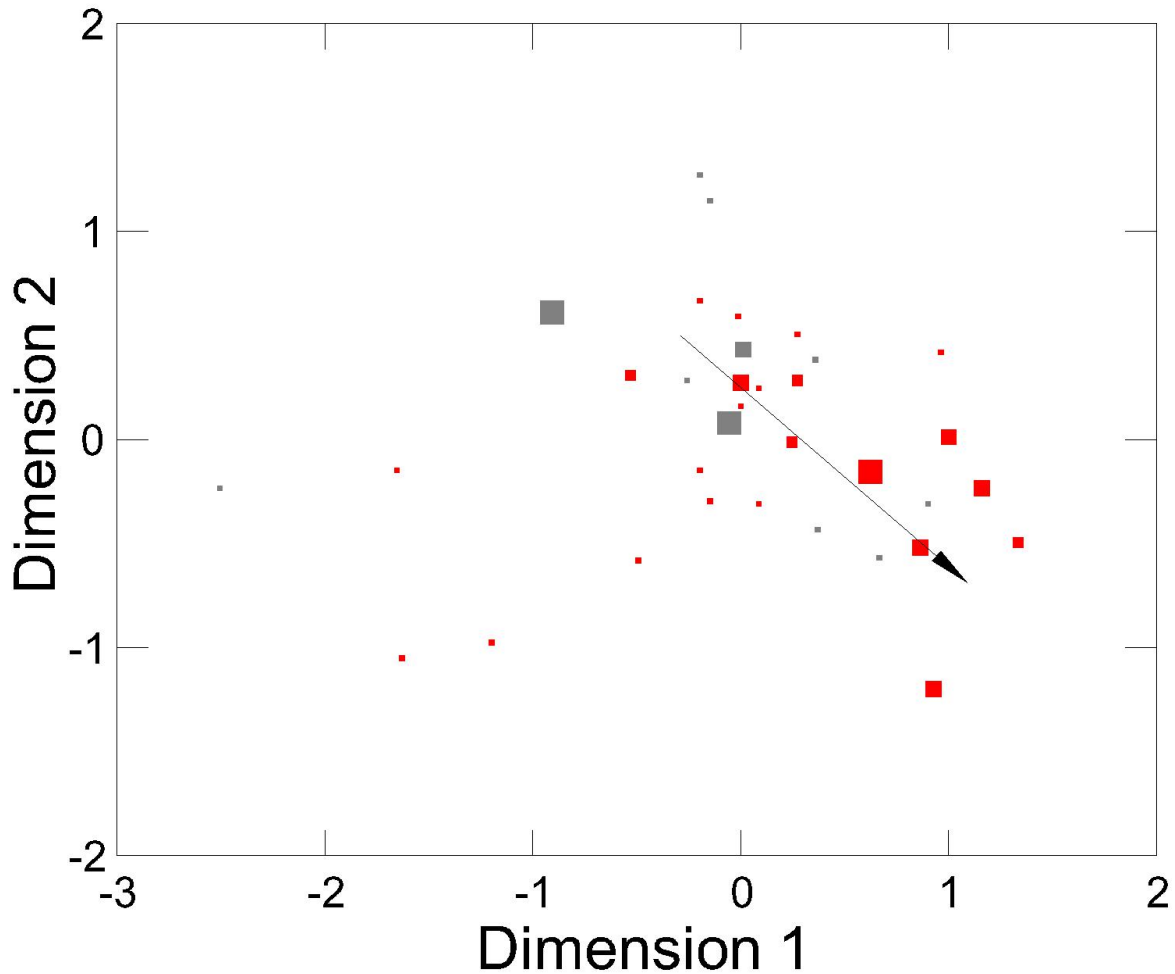


Figure 6.9 Variable 10 – Textile tools (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 500 sherds of various vessel forms)

There are 13 household units (including 3 less reliable cases) found with textile tools. The proportions of the textile tools behave in a gradual way, starting with low values in the upper left and moving toward higher values in the lower right part of the two-dimensional configuration. This shows that the household units more involved in textile production and weaving activities tend to stand in the lower right part of this plot. Although some squares in the plot do not follow this pattern, appearing towards the upper left, these are squares representing the less reliable ratios calculated from smaller samples. With reference to the wealth tendency, the household units who

were involved more in the textile production or weaving activities are in the moderate to low ranges of the wealth distribution. This pattern suggests that textile production, like resharpening, was not an activity which led commoner families to greater wealth.

6.1.11 Variable 18 – Shell production

The two-dimensional configuration indicating the values of Variable 18 – shell production (Figure 6.10) shows how the proportions of the number of shell artifact production remains divided by the number of sherds of identifiable vessel forms in each household unit in this sample behave. Larger squares represent household units with larger proportions of shell artifact production remains. In this sample, only 9 household units were involved in shell artifact production, with a fairly low proportion ranging from about 0.03% to about 0.20%; in other words, the ratios of the shell artifact production remains among the household units engaging in this production are from about one shell artifact production remain per 3333 sherds of identifiable vessel forms to about one shell artifact production remain per 500 sherds (Table 6.1).

If the ratio of about one shell artifact production remain per 3333 sherds of identifiable vessel forms is truly low, then the household units with only hundreds of sherds of identifiable vessel forms and no shell artifact production remains cannot be considered with a lower rate than the household unit with one shell artifact production remain per 3333 sherds of identifiable vessel forms. The median of ratios of the shell artifact production remains among the household units found with shell artifact production remains is about 0.1%, which means that there is possibly one or more shell artifact production remains per 1000 sherds of identifiable vessel forms. Thus, the household units with a sample size of sherds of identifiable vessel forms less than 1000 are less

reliable than those represented by a larger sample size. The less reliable cases are colored grey in figure 6.10.

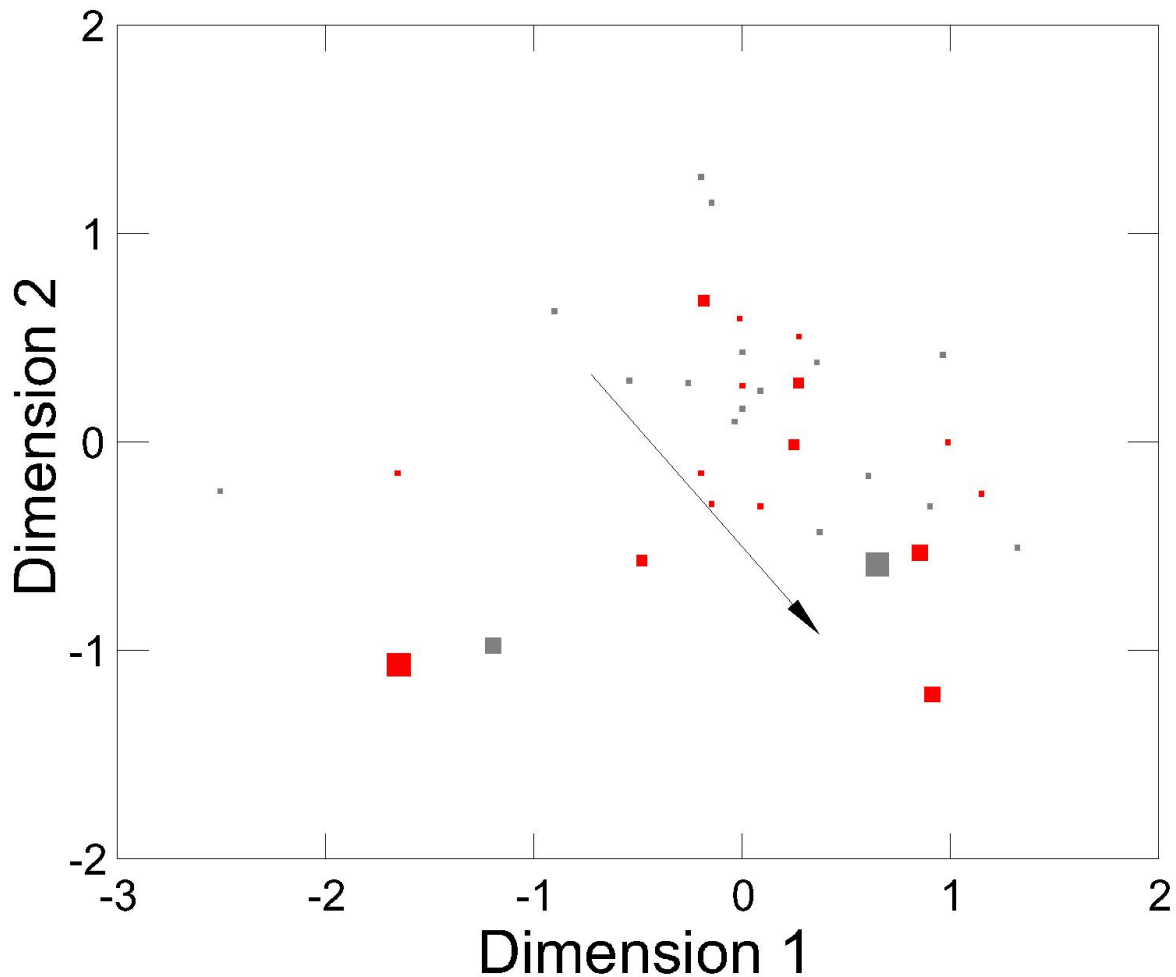


Figure 6.10 Variable 18 – Shell production (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

Only 9 household units (including 2 less reliable cases) in this household sample are found with shell artifact production remains. The proportions of the shell artifact production remains also behave in a gradual way, starting from low values in the upper left and moving to higher values in the lower right part of the two-dimensional plot. This patterning suggests that shell artifact production also was not an important or widespread economic activity among the household

sample, and only a few families were engaged in this production. The household units who were more involved in shell artifact production tend to appear in the lower right part of this plot, which is the moderate to low ranges of the wealth distribution. Such patterning suggests that shell artifact production also was not an activity which led the commoner families to greater wealth.

6.1.12 Variable 13 – Fishing tools

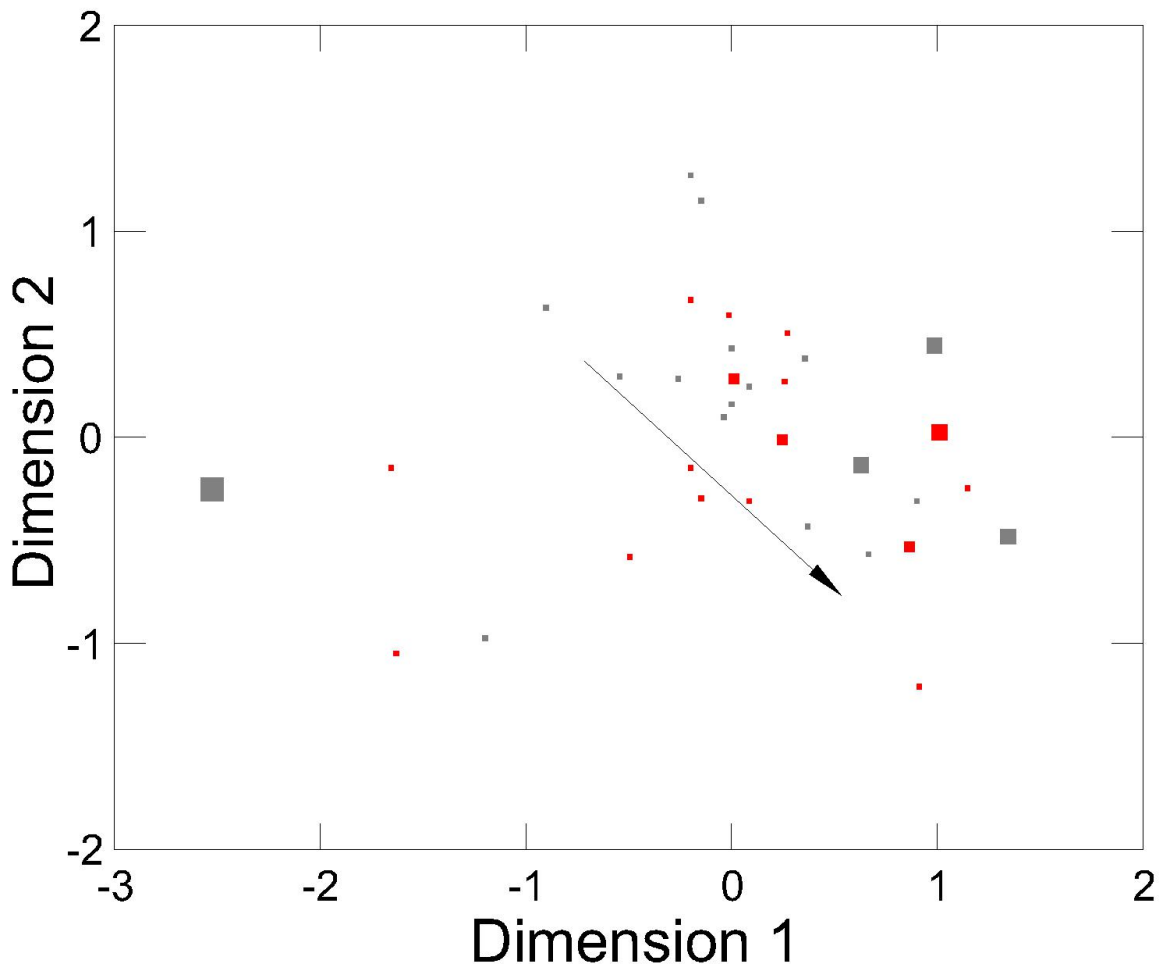


Figure 6.11 Variable 13 – Fishing tools (as a proportion of sherds of identifiable vessel forms; larger squares represent higher proportions; grey squares are the household units with fewer than 1000 sherds of various vessel forms)

The two-dimensional plot indicating the values of Variable 13 – Fishing tools (Figure 6.11) reveals how the proportions of the number of fishing tools divided by the number of sherds of identifiable vessel forms in each household unit in this sample behave. Larger squares represent household units with larger proportions of fishing tools. In this sample, only 8 household units are found with fishing tools, in proportions ranging from about 0.01% to about 1.92% (Table 6.1). In other words, the ratios range from about one fishing tool per 10000 sherds of identifiable vessel forms to about one fishing tool per 52 sherds.

If the ratio of about one fishing tool per 10000 sherds of identifiable vessel forms is truly low, then a household unit with only hundreds of sherds of identifiable vessel forms and no fishing tools cannot be confidently counted with a lower ratio than a household unit with one fishing tool per 10000 sherds. The median of the ratios of fishing tools among the household units found with fishing tools is about 0.1%. Such a ratio means that there is possibly one or more fishing tools per 1000 sherds of identifiable vessel forms in a household unit. Thus, the household units with a sample size of sherds of identifiable vessel forms less than 1000 are considered less reliable than those represented by a larger sample size. These less reliable household units are displayed in grey in figure 6.11.

There are only 8 household units (including 4 less reliable cases) found with fishing tools. The proportions of fishing tools in the household sample start with low values in the upper left and rise gradually toward the lower right part of the two-dimensional configuration, although one square representing a less reliable ratio from a small sample stands out in the lower left as a possible exception to this pattern. Such patterning suggests that fishing was not an important economic activity widely engaged in by the household sample, and only a few families in this household sample specialized in fishing activities. The household units more engaged in fishing

tend to appear in the lower right part of the plot, which is the moderate to low range of the wealth distribution. This suggests fishing was not an activity which could lead the commoner families to greater wealth as well.

6.1.13 Discussion of productive activities related to lower wealth

Variable 10 – textile tools, variable 12 – resharpening tools, variable 13 – fishing tools, and variable 18 – shell production pattern in a relatively similar way in the space defined by the two-dimensional configuration. The four variables all show gradual variation, to some extent, running from low values in the upper left corner to higher values in the lower right corner of the plot of Dimensions 1 and 2. This gradual variation parallels the wealth tendency but in the opposite direction from the productive variables discussed in the first half of this chapter. The household units that are high in the proportions of textile tools, resharpening tools, fishing tools, and shell artifact production remain tend to stand in the lower right (less wealthy) part of the plot. Thus, resharpening or smoothing, textile making or weaving, fishing and shell artifact production possibly could not offer good economic returns and commoner families in the Erlitou state could not accumulate wealth through focusing on these four productive activities.

6.2 Discussion

A set of 11 variables representing an array of productive activities engaged in by the household units in this sample are explored in this two-dimensional scaling. Such study of the productive activities conducted in the household contexts and by the household sample can

contribute to our knowledge of the economic interactions among household units and how the productive activities influenced the commoner families represented by the household units in this sample in the Erlitou state.

In the plot of dimensions 1 and 2, there is no clear tendency for any productive activities to cluster together, but a thoroughly mixed pattern (Figure 6.1 ~ 6.11). The proportions of the different kinds of practical tools are also all quite low among the household sample. If there was a highly specialized productive pattern among the household units, clustering by variables representing correlated productive activities is expected in the two-dimensional configuration. However, the household units in this two-dimensional configuration do not form any clear clusters by productive activities but mix together thoroughly in a complex array of productive activities. There is also no clear clustering by different locations within the Erlitou site, although bronze working was only seen in the palatial enclosure (G7 and G13) and the workshop enclosure (W5). The intermingled pattern and the quite low proportions of practical tools and remains suggest that productive differentiation was relatively modest in scope through the three locations of the Erlitou site. Such production was widely engaged in by the commoners in the household sample, although not all household units focused especially intensely on subsistence production. At the same time, some household units were involved in several different productive activities. The productive activities combine and recombine in constantly varying ways.

Such economic involvement in both production for themselves and extra commodities for exchange with other households did not promote the prestige of the household units in this sample. As chapter 4 has shown, prestige differentiation within the household sample starts at low values in the upper right corner of the two-dimensional configuration and rises to higher values toward the lower left corner. If productive differentiation had some relevance to prestige negotiation, the

household units more involved in productive activities for exchange should have appeared more in the lower left part of this two-dimensional configuration. Instead, most household units involved in the different kinds of productive activities for exchange are more likely to stand in the middle and upper part of the configuration space, especially the upper left or the lower right, but not in the lower left. Household units that participated more intensely in productive activities for exchange, regardless of what the productive activities were, tended to have moderate to low prestige. Some relatively prestigious household units were also engaged in agricultural activities, carpentry or construction activities, military or hunting activities and conducted production of antler or shell artifacts. But the more prestigious commoners generally did not emphasize productive activities, compared to the less prestigious families in this household sample, although there were some possibly exceptions. Thus, prestige was not negotiated or gained by involvement in productive activities represented by the 11 variables.

On the other hand, engagement in special productive activities for exchange with other households seems to have made it possible to augment household standards of living within the household sample, that is, to accumulate some degree of wealth (Figure 6.12). The proportions related to some productive activities parallel the pattern of wealth differentiation in the configuration space. Most household units involved in these productive activities stand in the upper-left-lower-right scope of the two-dimensional configuration. Variable 8 – carpentry/construction tools, variable 9 – agricultural tools, variable 11 – weapons/hunting tools, variable 15 – lithic production, variable 16 – bone production, variable 17 – antler production, and variable 19 – bronze working (figure 6.1 ~ 6.7) occur in higher proportions in the wealthier portion of the configuration plot. In contrast, household units with high proportions of variable 10 – textile tools, variable 12 – resharpening tools, variable 13 – fishing tools, and variable 18 – shell

production (figure 6.8 ~ 6.11) were likely to be in the lower right part of the two-dimensional configuration, suggesting moderate to low wealth (Figure 6.12). This patterning suggests that the productive activities represented by the former seven-variable set offered more economic returns than those represented by the latter four-variable set in the Erlitou economy. The household units emphasizing the first set of productive activities seem to have improved their standard of living while those whose productive activities focused on the second set did not, although the patterns are complicated. Such different emphases among the commoner families suggest not only that wealth redistribution happened, but also some exchange among household units happened in Erlitou society.

Agriculture was the main source of subsistence for Erlitou people. In this sample, over half of the household units were certainly involved in agriculture, suggesting that agricultural production by residents of the Erlitou settlement was important along with food tribute from the Erlitou rural hinterland in the Yiluo Basin (Liu 2006; Qiao 2010). Construction/carpentry activities were the second most widespread productive activity evidenced by the artifact assemblages of Erlitou household units. Certainly massive construction from Erlitou Phase 2 to Phase 4 was required to create the enclosed walls of the palatial enclosure and the workshop enclosure and build the array of palaces in the palatial enclosure. At the same time, population increase enlarged the demand for shelter. Construction/carpentry activities may have provided a good economic return because of this expanded demand. Weapons/hunting tools are also widely seen among the household units in this sample. Although arrowheads could serve in hunting to some extent, such artifacts, as discussed in Chapter 2, are more likely to be weapons. Weapons seen in the household context suggest that many commoners in the Erlitou state may have served in the armed forces in addition to their possibly economic duties represented by the weapons/hunting tools in household

contexts. With elite demands for procurement of natural resources through military expansion and the increased demands for defense against the rising political challenge from the Erligang polity (Liu and Chen 2003 and 2012; Liu 2006), the commoners might be paid off well for serving in the armed forces. Patterns of household units engaging in production of lithic tools, bone artifacts, and antler artifacts suggest that some commoners could also engage in tool manufacturing during the Erlitou period. Such production may have met local demand for productive or practical tools for agricultural production, carpentry or construction activities, military or hunting activities and textile making or weaving activities in conjunction with some supply of lithic raw materials and, even, some tools from other settlements in the Erlitou hinterland, like Shaochai 稍柴 and Huizui 灰咀 (Chen et al. 2003; Ford 2004; Chen, X. 2006; Liu, Chen, and Li 2007; Zhongguo 2014; Qian et al. 2014; Zhongguo and Zhongamei 2019), and the emphases on such production also probably contributed to wealth accumulation. Bronze-casting is believed to be a high-level complex economic activity and has been identified as an important elite-oriented productive activity in the workshop enclosure. If there was indeed household-based bronze working as well, the involvement in bronze-working probably could enable commoner families in the palatial enclosure and the workshop enclosure to be at least in the medium range of the wealth distribution in the scaling space. Similarly, turquoise artifacts were another luxury goods monopolized by the Erlitou elites. A turquoise workshop was identified in the northern part of the workshop enclosure in 1999 - 2006. Including some household units from the possible turquoise workshop area, some household units (G13, G18/F1, W2, W5 and D4) are associated with the turquoise debris in this household sample. Because the huge quantity of turquoise debris (4084) in W5 would create a large imbalance in the patterns in the scaling space and vastly outnumbers the turquoise debris associated with the other 4 household units (10 in G13, 1 in G18/F1, 1 in W2, and 1 in D4), turquoise production was

not included in the multi-dimensional scaling. Given the small size of the turquoise debris in the G18/F1, W2 and D4, it is inconclusive to say they were involved in the turquoise item production, and the turquoise debris might have been casually and occasionally incorporated into the household garbage, although W2 is in the area of turquoise workshop and there are no other turquoise manufacturing spots identified in the palatial enclosure and the east end of the site. In contrast, G13 and W5 were possibly specialized in turquoise item production. W5 was highly specialized in turquoise manufacturing, so W5 might be an important specialized worker family in the turquoise workshop emphasizing turquoise manufacturing. The much smaller amount of turquoise debris in G13 suggests G13 possibly did not focus as much as W5 on turquoise item production and possibly served for mending turquoise items for the royal elites. Just like the possibly specialized bronze-working families, the household units specialized and involved in turquoise artifact production also were at least in the moderate range of wealth distribution in this household sample. Thus, it is possible that, because of their important contributions to provide subsistence goods, shelter, practical tools, and community safety, some households gained good economic returns from special productive activities. Specialization and involvement in bronze smelting/casting (if possible) and turquoise production satisfied the royal elites' demands for luxury goods and ritual consumption so that the service to and the relationship to the royal court could also possibly enable the commoner families to accumulate some degree of wealth and improve their standard of living.

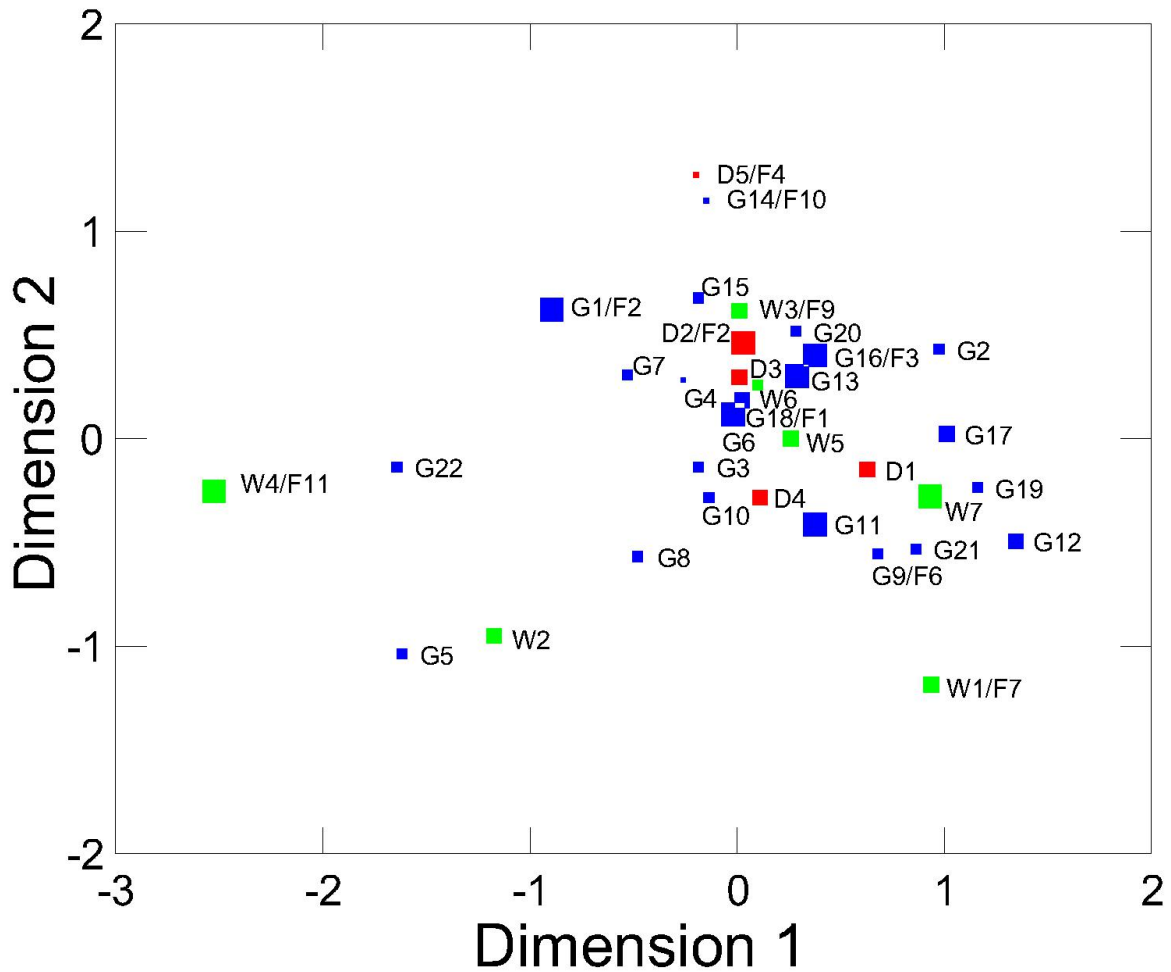


Figure 6.12 Household units with the highest proportion of artifactual evidence of special productive activities from different regions in different colors

(The size of each square indicates the highest proportion of artifactual evidence of any productive activity engaged in by the corresponding household; household units in or near the palatial enclosure in blue, household units in or near the workshop enclosure in green, and household units in the east end of the site in red)

Other productive activities seem not to produce extra household wealth or are only engaged in by less wealthy household units; these are activities that do not seem to enable households to accumulate wealth. Compared to cultivated plants and herded animals, fish were not heavily consumed by the people in the Erlitou site. This may have limited economic returns from fishing.

The less wealthy household units with more fishing tools might have been driven to pursue this less desirable but readily available resource. Similarly, people in the Erlitou site probably did not focus on the consumption of river mussels as food. Such small consumption of river mussels could lead to an unstable or small raw material supply for shell artifact/tool production because the shell tools were particularly made of the shells from Lamellibranchia in prehistoric China (Lv and Fu 2010; Hu 2018). Lack of stable supply of raw material not only might have made the Erlitou people rely less on shell tools compared to lithics but also may have meant that shell artifact/tool production did not offer good economic returns. Some less wealthy commoner families, as a consequence, may have engaged in shell artifact/tool production just to get by. Whetstones are believed to be widely used to resharpen the blades on agricultural tools, carpentry or construction tools, and weapons, and sharpen or smoothen goods made of stone, bone, antler, tooth, shell, turquoise, bronze, and jade. Whetstones could be auxiliary to other economic activities in some commoner families. However, some household units were involved in agricultural or other activities but not associated with whetstones, especially some in the higher range of wealth distribution. Such patterning suggests the relatively wealthy commoner families might focus on their own economic production and turn to less wealthy commoner families for resharpening their tools, and the commoner families who were in the moderate to low ranges of wealth might conduct some resharpening or smoothing in addition to the production they were engaged in for survival. Textile or clothing making was also participated by only a few commoner families, some relatively wealthy household units and some household units who are in the moderate to low ranges of wealth distribution in the scaling space. The commoner families in the moderate to low ranges of wealth distribution could focus more on this activity than the relative wealthy commoner families,

possibly suggesting that some less wealthy commoner families could not accumulate wealth but could manage to survive through focusing on textile or clothing making.

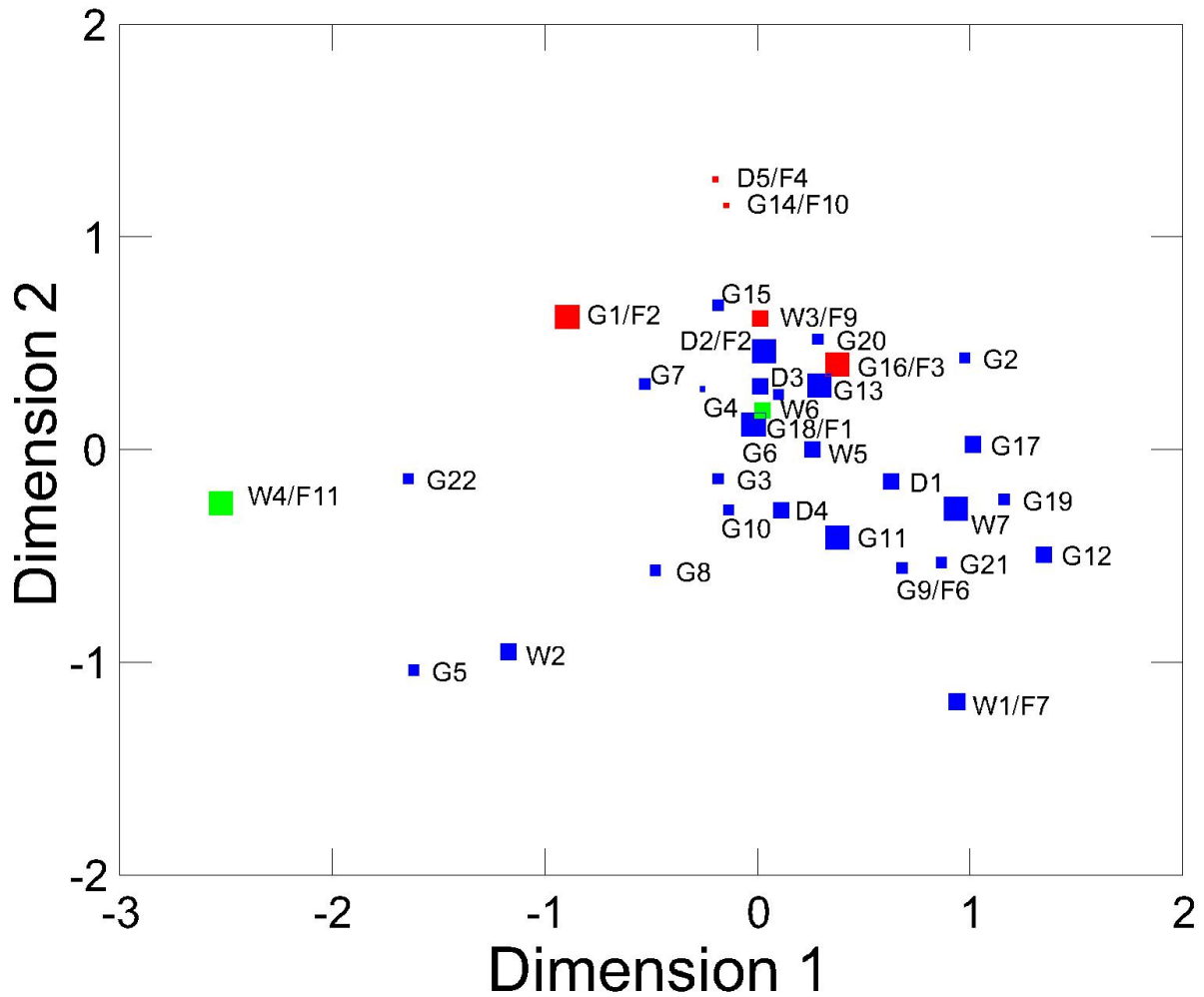


Figure 6.13 Household units indicating the highest proportion of tools for productive activities colored by different housing structures

(Each square size based on the highest of all the proportions of tools for productive activities the household unit engaged in; household units living in small above-ground housing structures in red, household units occupying semi-subterranean housing structures in green, household units with unknown housing structures in blue.)

Although some of the household units living in the small above-ground housing structures (G14/F10 and D5/F4) were found no any practical tools and some household units living in the

small above-ground housing structures or the semi-subterranean housing structures are represented by small less reliable sample, the household units living in the small above-ground housing structures were still likely to invest more effort or time in economic activities, especially in those that offered greater returns (Figure 6.13). And these household units were more likely to be seen in the upper left (the wealthier part) in this two-dimensional plot. Such patterning indicates that involvement in the well paid-off productive activities probably enabled commoner families to procure wealth and better their standard of living.

Table 6.1 Proportions of the variables related to productive activities engaged in by the 34 household units

(the largest proportions of each household unit are in red)

Household unit	Construction/carpentry tools	Agricultural tools	Textile tools	Weapons/hunting tools	Resharpening tools	Fishing tools	Lithic production	Bone Production	Antler production	Shell production	Bronze working
G1/F2	0.0122	0.0061	0.0061	0.0061	0.0000	0.0000	0.0122	0.0061	0.0122	0.0000	0.0000
G2	0.0000	0.0017	0.0000	0.0000	0.0017	0.0017	0.0000	0.0017	0.0000	0.0000	0.0000
G3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000
G4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G5	0.0007	0.0007	0.0000	0.0007	0.0007	0.0000	0.0000	0.0000	0.0007	0.0020	0.0000
G6	0.0067	0.0067	0.0067	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G7	0.0000	0.0022	0.0011	0.0011	0.0000	0.0000	0.0011	0.0011	0.0022	0.0000	0.0011
G8	0.0000	0.0004	0.0000	0.0000	0.0004	0.0000	0.0000	0.0009	0.0000	0.0004	0.0000
G9/F6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0020	0.0000	0.0000	0.0020	0.0000
G10	0.0008	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
W1/F7	0.0000	0.0008	0.0016	0.0000	0.0032	0.0000	0.0008	0.0024	0.0000	0.0008	0.0000
W2	0.0000	0.0032	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.0011	0.0011	0.0000
D1	0.0012	0.0000	0.0037	0.0000	0.0025	0.0012	0.0025	0.0000	0.0000	0.0000	0.0000
D2/F2	0.0000	0.0059	0.0030	0.0030	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G11	0.0000	0.0000	0.0000	0.0110	0.0055	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G12	0.0011	0.0000	0.0011	0.0011	0.0000	0.0011	0.0000	0.0046	0.0000	0.0000	0.0000
G13	0.0016	0.0012	0.0008	0.0032	0.0004	0.0000	0.0004	0.0059	0.0008	0.0004	0.0024
G14/F10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G15	0.0005	0.0005	0.0000	0.0005	0.0000	0.0000	0.0015	0.0024	0.0000	0.0005	0.0000
G16/F3	0.0000	0.0029	0.0000	0.0087	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
W3/F9	0.0029	0.0000	0.0000	0.0020	0.0010	0.0000	0.0010	0.0000	0.0000	0.0000	0.0000
W4/F11	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0000	0.0000	0.0000	0.0000	0.0000
W5	0.0009	0.0016	0.0012	0.0010	0.0039	0.0001	0.0006	0.0025	0.0000	0.0003	0.0003
W6	0.0025	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0025	0.0000	0.0000	0.0000
W7	0.0000	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0060	0.0000	0.0000	0.0000
D3	0.0012	0.0024	0.0035	0.0012	0.0024	0.0006	0.0047	0.0000	0.0000	0.0000	0.0000
D4	0.0018	0.0009	0.0000	0.0000	0.0026	0.0000	0.0022	0.0018	0.0000	0.0000	0.0000
D5/F4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
G17	0.0013	0.0026	0.0026	0.0006	0.0006	0.0019	0.0006	0.0006	0.0000	0.0000	0.0000
G18/F1	0.0010	0.0030	0.0000	0.0040	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000
G19	0.0014	0.0025	0.0018	0.0014	0.0007	0.0000	0.0007	0.0007	0.0000	0.0000	0.0000

G20	0.0009	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000
G21	0.0017	0.0009	0.0017	0.0000	0.0009	0.0009	0.0000	0.0000	0.0000	0.0017	0.0009	0.0000
G22	0.0009	0.0009	0.0000	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

7.0 Conclusions

7.1 Response to research question 1

How much wealth differentiation is detectable among the households in this sample?

Wealth differentiation is detectable from the distribution of artifacts across the 34 households in this sample, although the degree of wealth differentiation is only moderate. Compared to the luxurious standard of living of the elites, the household units this research studies must fall pretty low on the Eritou wealth scale and entirely outside of the elite group. One might suppose that commoners in an early city would be a great mass of population with very little differentiation in wealth (Marcus 2004). However, this sample of households displays that there was enough wealth differentiation among the commoner families to detect, and even the limited ability offered by archaeological household artifact assemblages can detect variation in wealth or standards of living. One may also suppose that the less wealthy families, or the commoner families, were totally excluded from the palatial enclosure in that the palaces were occupied only by the ruling elites. However, this household sample displays that some commoner families did live next to the palaces, and the commoner families in or near the palatial enclosure are not all wealthier than the commoner families in the other two locations. As the value of goods is related to multiple factors like their beauty, rarity, distance, and labor intensity (Brysbart 2017) and elite-oriented production only satisfies the elites' exclusive demand for high-value, special goods, one may suppose that involvement or specialization in elite-oriented production could enable commoner workers to accumulate wealth. The known Eritou elite-oriented productions are turquoise item production and bronze casting. In this household sample, there are only one commoner household

strongly focusing on turquoise production in the turquoise workshop and one commoner household involved in turquoise production and 3 commoner households possibly involved in bronze working, which are in the medium to high range of the wealth distribution. So, elite-oriented production could enable commoners to accumulate some wealth in the Erlitou state, to some extent. There are still some relatively wealthy commoners from the east end of the site which is farther from the palaces and not specialized in elite-monopolized production. This study finds that some of these households did accumulate more wealth than others, but that the commoner households in this sample who got a bit wealthier than others could be in the palatial enclosure, the workshop enclosure, or the east end of the site, and the households that did not get any wealthier than others occurred in all these locations as well. The moderate but gradual differentiation in the wealth distribution suggests that the commoner families in the Erlitou site possibly had their own pathways to accumulate wealth and improve their standard of living.

7.2 Response to research question 2

How much prestige differentiation is detectable among the households in this sample?

Prestige differentiation is detectable across the 34 household units in this sample from the distribution of artifacts, although the detectable differentiation in prestige is only moderate. Compared to the tremendous prestige enjoyed by the elites, the household units this research studies fall pretty low on the scale of the Erlitou prestige spectrum and entirely outside of the elite group. One may suppose that only the extremely prestigious families were in the palatial enclosure, or, in other words, commoners in terms of prestige were excluded from the palatial enclosure (Zhongguo 2003; Xu 2009 and 2022). However, this household sample displays that there are still

some commoner families living next to the royal elites in the palatial enclosure. On the other hand, the 34 commoner households are likely not to be at the very bottom of the Erlitou “social pyramid” given some being close to the palaces. Some commoner families still had some access to the court of the divine rulers and the royal ancestral temple suggested by the spatial organization so that they might still appreciate some level of prestige.

One might also suppose that commoners in an early city would be homogeneous with little differentiation in prestige (Marcus 2004). However, the commoner families in the Erlitou site still might have some pathways to improve their prestige suggested by the small number of the nuanced prestigious commoner families in this sample, but wealth and prestige were separate and unrelated dimensions. In this sample, wealthy families were not particularly prestigious and prestigious families were not particularly wealthy. This suggests that the ability to gain the respect of others or prestige was not enhanced by accumulation of wealth in this household sample. The Erlitou state might have formed a system for the commoner families to raise their prestige. On the other hand, this study only investigates a small sample of commoner households (34) so it still cannot fully rule out that feasting or other kinds of generosity had the effect of inflicting debt on others and earning respect and reciprocal obligations because such may have been practiced among the Erlitou commoners although such was not clearly observed in this household sample. Thus, it is still inconclusive to say what the system was and how it worked. Although it is possible to relate their positions to service to the ruling elites, it still requires more work to figure out what principles lay behind the negotiation of prestige by the Erlitou commoners.

7.3 Response to research question 3

How much ritual differentiation is detectable among the households in this sample?

Ritual differentiation is detectable from the household artifacts across the 34 household units, although the detectable ritual differentiation is not much. One might suppose that the Erlitou commoners were completely excluded from all kinds of ritual activities. Compared to the multiple forms of ritual activities and the high-quality ritual paraphernalia of the (ruling) elites, the 34 household units in this sample were involved in very few ritual activities. They did not, for example, participate in the shaman dances with bronze-turquoise ritual paraphernalia and bells and drums in the hope of prosperity and bliss (Cai 2006; Du 2006; He 2018; Gao 2022). So, the commoners indeed were pretty low on the Erlitou ritual spectrum. However, the household assemblages suggest that the Erlitou commoners still could participate in oracle divination by scapulimancy. The commoner households in this sample, as a group, did not participate in scapulimancy very much, but about half of them (18 out of the 34 household units) still participated in scapulimancy. On the other hand, the household units more involved in divination tend to be closer to the palatial enclosure, especially to the suggested ancestral temples. Being near the palaces is not the only way that commoner households were able to participate in scapulimancy, but household units near the palaces were definitely more involved in this activity than other household units were (at least in this sample), suggesting that some household units in the palatial enclosure might be slightly more focused on divination in the hope of an auspicious future, and divination might also be related to (royal) ancestral veneration. It is possibly true that involvement in most ritual activities and ritual status were prestige related in the Erlitou state because the elites monopolized most of the ritual activities and ritual duties, but it is inconclusive what reason constrained the commoners from divining their own welfare; there is no real detectable difference

in ritual participation between the wealthy and the prestigious commoner households in the scaling space.

7.4 Response to research question 4

How much productive differentiation is detectable among the households in this sample?

Productive differentiation is detectable among the household units in this sample although the detectable productive differentiation is modest. Based on the workshop enclosure, which is composed of the known turquoise workshop and the bronze-casting workshop, and other workshops outside the workshop enclosure, the Erlitou site seems to emphasize a workshop economy through which the population obtained handicrafts and goods through the workshops and the workshop enclosure provided the monopolized consumption of turquoise items and bronze artifacts to the Erlitou elites (Zhongguo 2003; Zhao and Zhang 2021). Meanwhile, the Erlitou site has also been argued to rely on crop tribute from the Erlitou rural hinterland (Liu 2006; Qiao 2010). However, the household assemblages across the 34-household sample suggest that the household units this research studies almost all participated in the production of daily necessities. Agricultural production was participated in by more than half of the household units in this sample. Some other household units might have focused on the production of daily necessities other than subsistence goods. So, the commoner households in this sample might vary in their opportunities and capabilities in wealth accumulation because of different focus and investment in the productive activities. The moderate productive differentiation might still enable some exchange in the society

so that some commoners could invest more energy in much more complex production like the bronze casting and turquoise item production to satisfy elite demand.

7.5 Response to research question 5

Whatever differentiation is documented in answering the questions above, how much of it seems to differentiate households living in small above-ground structures as a group from those living in semi-subterranean structures?

Differentiation in wealth, prestige and production is detectable among the two household groups represented by two different housing structures in this household sample although such detectable differentiation is modest, while the ritual differentiation is not detectable. One may suppose that the households living in the small above-ground structures would be wealthier, and more prestigious than the households living in the semi-subterranean structures and the households living in the semi-subterranean structures would participate more in production (Zhongguo 2003; Xu 2009 and 2022). The households living in the small above-ground structures in this sample indeed are wealthier than the households living in the semi-subterranean structures and their standard of living was probably improved by their investment in productive activities, especially the well paid-off activities. On the contrary, the households living in the small above-ground structures in this sample are actually less prestigious than the households living in the semi-subterranean structures. Such patterning suggests that the investment or participation in production was one effective way for the Erlitou commoners in this sample to accumulate wealth and better their standard of living, but the labor mobilization or labor investment represented by the housing structure did not effectively represent the commoners' prestige or reputation in this household

sample. Because of the small sample size, there is no clear patterning of the ritual differentiation among the two household groups.

However, definitive statements about any kind of differentiation between the two groups of household units are still inconclusive. There are 27 household units in this sample the nature of whose residential structures cannot be determined (24 represented by household garbage without associated housing structures and 3 with very poorly preserved associated housing structures). Thus, the small sample of data makes it hard to answer this question with much confidence.

7.6 Response to research question 6

Whatever differentiation is documented in answering the questions above, how much of it occurs among households living in small above-ground structures and how much among those living in semi-subterranean structures?

There is not much wealth-, prestige-, or productive-differentiation occurring among the household units living in the small above-ground structures, but there is some differentiation in wealth, prestige and production detectable among the household units living in the semi-subterranean structures in this sample, and there is no clear ritual differentiation detectable among households living in either the small above-ground structures or in the semi-subterranean structures in this sample. The relatively close distance between the household units living in the small above-ground structures suggests little differentiation in any dimension among these household units; they shared a similar level of wealth, prestige, and production. The households living in the semi-subterranean structures in this sample display that the slightly wealthier one is less prestigious while the slightly more prestigious one is less wealthy; the wealthier one focuses

more on productive activities while the slightly prestigious one seems not to emphasize productive activities. There is only one household unit living in a semi-subterranean structure associated with scapulimancy. Such a small sample cannot lead to any conclusions about ritual differentiation among the households living in the small above-ground structures and among the household units living in the semi-subterranean structures.

However, the answer to this question is still tentative and inconclusive. In this sample, there are only five households living in the small above-ground structures and only two households living in the semi-subterranean structures, and some household units are represented only by small household assemblages. Thus, the small sample of data makes it hard to answer this question with much confidence.

7.7 Summary

This research offers some new understandings of the commoners' life in the Erlitou territorial state. Compared to the Erlitou ruling elites, the Erlitou commoners definitely were plain, less prestigious, mundane, but some were entrepreneurial. No kind of differentiation among the commoner families in the Erlitou site was strong, but only moderate. They probably shared in the low range of the wealth accumulation in the whole spectrum of the Erlitou state. Compared to the Erlitou elites, their houses were not spacious. They lived in small housing structures, both above-ground and semi-subterranean structures, but they still could accumulate some wealth to improve their standard of living which could be represented by their capacity to store goods. Differences in the proportional consumption of storage ceramic vessels suggest disparities in wealth accumulation, although the disparities could be moderate. Slightly wealthy commoner families

could also have more opportunities to consume pottery vessels decorated in complex patterns and personal ornaments and to live in small above-ground housing structures instead of the cold, damp, and low semi-subterranean housing structures.

Archaeologists found a specialized bronze casting workshop in the Erlitou site, and a specialized workshop enclosure including the known bronze-casting workshop and the turquoise workshop (Zhongguo 1999, 2003 and 2014). The complex specialized production, the large-area specialized workshops, and the palatial enclosure suggest that the Erlitou site was an ancient city composed of administrators and specialized elite-oriented craftworkers. Recently identified bone workshops and some crafting spots for pottery, lithic and antler production seem to reinforce the opinion that the Erlitou site focused strongly on craft production (Chen and Li 2016; Zhao and Zhang 2021). According to the diachronic and the site-section-based (the Erlitou site is divided into 15 sections by modern roads and village plans) differences in productive tools found in the 1959 – 1978, Liu (2006) argues that there was a mixed economy and that the Erlitou urban population includes not only elites and elite-oriented craftworkers but also independent craftworkers and farmers, although farmers were only a small portion of the population compared to craftworkers. Thus, because of the relatively low proportion of agricultural tools found in the 1959 – 1978 excavations and the large urban population in the Erlitou site (about 20,000 to 25,000, a considerable portion of which were supposed craftworkers), the Erlitou site has been argued as not self-sufficient and reliant on a large amount of food tribute from the hinterland (Liu 2006; Qiao 2010).

The palatial enclosure, the workshop enclosure in which elite-oriented bronze casting workshop and turquoise workshop satisfied the elite demand for luxury goods, and some relatively large rammed earthen structures outside the palatial enclosure suggest that not only were there

very exalted elites living a luxurious life in large and elaborate palaces and exercising considerable power, but some intermediate elites at a lower level also enjoying some wealthy and prestigious life. The elite economy with attached specialists making elite goods in workshop is one feature of Erlitou suggested by the complex elite-oriented bronze casting workshop and the turquoise workshop (Zhongguo 1999, 2014 & 2019; Liu and Chen 2012; Xu 2009 & 2022). However, the small housing structures around the settlement, and the large pile of mundane and non-luxury daily life artifacts both suggest there were many less wealthy and less prestigious households living in Erlitou, and many of them may even have lived farther from the palace and workshop and even in the rural area centering at Erlitou. The large number of Erlitou commoners presumably conducted all kinds of economic activities to feed themselves and the Erlitou elites, and some of them conducted specialized elite-oriented production to support the elite luxury and prestigious life. Therefore, Erlitou did not consist primarily of elites and elite-oriented craftsmen who produced luxury goods for the elites. The vast majority of the Erlitou population was probably much more like the people of the 34 households presented in this study. With entrepreneurial and industrious involvement in household-level production, some commoner families like the 34 households, although not extremely wealthy and prestigious, were probably the “middle class” in the Erlitou hierarchical “social pyramid”.

This research finds that, besides the food tribute and the specialized workshop production, the Erlitou commoners not only contributed to the whole community but also accumulated some wealth through some household-level production. Differences in the proportional composition of practical tools and productive debris in the household assemblages suggest that the Erlitou commoners emphasized different productive activities. Some of them produced daily subsistence on their own and some of them also spent some extra effort on other production. They could

accumulate some wealth through their investment in production, enough to provide for a slightly higher standard of living. By emphasizing some better paid-off economic activities, some commoners could also accumulate wealth more effectively than others. Furthermore, the moderate productive differentiation in the household sample represented by the different productive tools and different economic activities suggests some degree of economic interdependence in which some households depended on others for certain kinds of goods, and those goods included not just crafts but also food. Not all of them, but about half, participated in agricultural production. Non-food production suggests that the commoner households in this sample were not completely self-sufficient. The “extra” food produced by some commoner households in the Erlitou site could help to feed the elites and other households who did not produce their own food in conjunction with the crop tribute from the Erlitou hinterland. Granaries in the bronze age of China have been found in the Dongxiafeng 东下冯 site and the Yanshi Shang city 偃师商城 (both in the Erligang period) suggesting that the Erligang (ruling) elites had the capacity of collecting, controlling, and storing crop food in large amounts (Zhongguo et al. 1988; Cheng and Zhou 1998; Shi and Jing 2018; Cao 2019). Although so far there is no identified granary in the Erlitou site, the Erlitou ruling elites should also have the capability to control and manage the collection of extra food and crop tribute and serve in charge of the redistribution of the crops in order to sustain their authority and sovereignty, and support the Erlitou craftsmen, especially those engaging in elite-oriented production. The Erlitou ruling elites, confronting population increase, might also have enhanced their centralized control of the natural resources, both subsistence and exotic raw materials for crafts, to maintain their authority and sovereignty. Such differentiated economic emphases among the commoner families suggests some exchange in Erlitou society as well as wealth redistribution happen, to some extent, in the Erlitou state. Thus, the economy in the Erlitou state was composed

not only of some craft workshop-based production, but also some household-based production of the daily necessities and crafts, and some agricultural production for subsistence. The Erlitou elites may have collected the extra food produced by local households and households from the hinterland and redistributed it to support themselves and commoner craftworkers.

The extremely small amount of ritual paraphernalia associated with commoner household contexts suggests that they probably were excluded from most ritual activities and ritual duties. An array of bronze, turquoise, jade, and lacquerware ritual paraphernalia exclusively seen in the Erlitou elite tombs suggests that the Erlitou (ruling) elites monopolized and professionalized worship, conducting ancestor veneration, and the worship of and sacrifices for supernatural spirits and gods. A large worship and sacrificial area (extending 300 meters east to west and 200 meters north to south) is located 200 meters to the north of the palatial enclosure. Ritual facilities, several elite tombs accompanied by bronze and jade ritual paraphernalia, and little daily garbage inside of this area, plus its proximity to the palatial enclosure, suggest that this is an Erlitou elite ritual area (Zhongguo 2003; Li 2006; Du 2019). It includes three round rammed-earth altars *tan* 坛 and some rectangular semi-subterranean pits *shan* 壇, which are argued to be for Erlitou's heavenly and earthly worship because of the similar forms of the Neolithic ritual buildings of Hongshan culture, Liangzhu culture, and Xinzhai phase, and the later Shang and Zhou ritual buildings (Li 2006; Du 2019; Zhongguo 2019; Xu 2009 and 2022). The (ruling) elites might practice shaman dances and sacrifices with high-quality ritual paraphernalia and carry out ritual activities in the hope of an auspicious future, happiness, and good harvest.

But the Erlitou commoners still have an even but moderate access to divination. In this commoner household sample, 18 households had some opportunities to practice scapulimancy. Lack of evidence that any of them had access to a storage of unused oracle bones and the small

amount of used oracle bones suggest that they still relied on professional diviners to help them conduct the divination. In this case, the commoners probably did not serve in the Erlitou religious duties and only stayed in the low range of ritual-related social status. However, the factors that constrained the capacity of commoners to divine their own welfare are unknown; there is no clear detectable connection between scapulimancy and wealth or prestige among the commoner households in this sample. Since the sample size is small, it cannot be completely ruled out that the Erlitou commoners' divinations were subject to their wealth or prestige. More ritual data from the Erlitou commoners collected in the future will enable us to better understand what principle decided the opportunities of the Erlitou commoners to practice divination.

The Erlitou commoners also shared a similarly low level of prestige, possibly because of their low-level ritual status or low involvement in ritual activities. Some archaeologists argue that during the early phase of state formation in China, religious activities were monopolized by the elites (Chang 1989; Feng 2013). By interpreting the lacquered wood stick found in a Taosi 陶寺 elite tomb as a gnomon (*Niebiao* 桀表) in the late Neolithic China, Feng (2013) argues that the Taosi elites were professionals in solstice surveying, through which they monopolized heavenly observation and worship, connected with the gods and spirits, and, furthermore, legitimized their centrality and authority. Based on the motifs on Yangshao pottery and an array of Longshan and Liangzhu ritual jades in late Neolithic China, Chang (1989) argues that ritual activities and religious duties have been long monopolized by the elites and lasted through the Three Dynasties, for example, the Shang (ruling) elites consumed tons of oracle bones and bronze vessels during their ritual practices. The Erlitou (ruling) elites were also likely to maintain their prestige and, furthermore, their sovereignty through their monopoly on ritual duties, the communications with ancestors and gods, and the heavenly worship represented by the much greater amount and the

forms of ritual paraphernalia that they used. Because of new forms of ritual paraphernalia, the Erlitou elites had to find their way to procure the raw materials and natural resources to support their ritual power, and the bronze metallurgy represented by the piece-mold techniques enabled the Erlitou elites to consume new bronze ritual paraphernalia. Liu and Chen (2003 and 2012) argue that the Erlitou state might have had the capacity to satisfy the Erlitou (ruling) elites' demands for raw materials and natural resources from the Erlitou periphery according to the enlarged Erlitou cultural sphere and the outpost sites seen in the west and south from which the Erlitou elites could obtain copper, tin, lead, and salt. Such procurement probably was to maintain the Erlitou (ruling) elites' ritual-related high status and prestige-related high status and, furthermore, their sovereignty and authority. In contrast, the commoners' prestige lacked a basis in ritual duties because of their modest involvement in ritual activities although they still could do some divination. Being less prestigious suggests the Erlitou commoners probably lacked capacity to join the different types of ceremonies and carry out ceremonial duties including ritual duties, so they seemed to be unlikely to consume the prestigious artifacts. Although there was nuanced economic power among the commoner families represented by the stored goods, feasting utensils and vessels, and the standard of living (the types of shelters), and some slightly wealthy families might be more able to share food and fermented beverages and live in a better structure (small above-ground houses), their prestige probably was not based on such capacity.

Although this research does not find what the commoners' prestige was based on, some commoner families from the palatial enclosure and the workshop enclosure who were slightly more prestigious among the household sample suggest that commoners' prestige may have been related to their relationship to the royal court. Some prestigious commoners alongside other commoners may have served the ruling elites and their family on a daily basis, forming the

hierarchical system in the palatial enclosure, and some prestigious commoners who may have specialized in elite-oriented production may serve in the hierarchical system in the workshop enclosure. Thus, access to the royal courts and to the elite-oriented production suggests the commoner families in this sample were not positioned at the very bottom of the Erlitou social hierarchy, but still enjoyed some prestige. In order to figure out what was possibly behind the prestige-related higher status commoners, future work should be focused on the Erlitou commoners, especially on those from the palatial enclosure and the workshop enclosure where the relatively prestigious commoners are likely to be found. More comparative studies focusing on the commoner families in the palatial enclosure and the workshop enclosure will probably enable us to figure out how the Erlitou commoners could negotiate their prestige or on what the prestige of the Erlitou commoners was based.

A person's reputation and respect may come from their professions or specific skills, not just from personal charisma and generosity (Brysbaert 2017). Also, higher proficiency and a longer-time span engaging in one skill or profession both can increase one's reputation and respect about that of others in one community or peer group. Drennan and his co-workers (2017) have found that Hongshan commoners' prestige has a connection to involvement in production; the households with higher prestige tended to be more focused on production. Filippini (2017) studies the ancient blacksmiths of the western Hallstatt area in the Europe between First and Second Iron Ages and argues that the blacksmiths, monopolizing the advanced technical skills, enjoyed a higher status through consumers' dependence on their products. Although the 34 household units this study investigates show no clear connections between prestige and production of daily necessities among the Erlitou commoners, the subject is still worth investigating. The currently argued Erlitou elite-oriented production is bronze casting and turquoise production. Recently, some other

workshops like bone workshops have been found in the palatial enclosure (Chen and Li 2016; Zhao 2022). Being close to the ruling elites suggests that these workshops in the palatial enclosure may also be elite-oriented. The number of the households involved in elite-oriented production in this sample is too small to reach any clear conclusion about this issue; there is only one household unit (W5) from the turquoise workshop that focused strongly on turquoise production, the three household units who were possibly involved in bronze-working not only participated little in it but also were not from the bronze-casting workshop, and no one in the palatial enclosure is from the workshops in the palatial enclosure. Future excavations in the palatial enclosure and the workshop enclosure could collect more data on the commoner households, especially those who were involved in elite-oriented production. Compared with the commoner households who only focused on the production of daily necessities and subsistence, we can figure out if the involvement in the elite-oriented production could promote the commoners' prestige.

A higher status commoner, or a more prestigious commoner can also be represented by how they participate in the economic networks. By investigating the sources of the Hongshan households procuring pottery, Li (2016) finds that the higher-status households practiced in the economic networks in different ways from the lower-status households; higher-status households could balance their social and economic ties to other households through their pottery procurement. As we have found that the relatively prestigious commoner households are likely to be found in the palatial enclosure and the workshop enclosure, and the prestigious commoners seem not to emphasize productive activities, we can choose the daily pottery from the prestigious and less prestigious commoner households in the palatial enclosure and the workshop enclosure to investigate how the prestigious and less prestigious Erlitou commoners participated in the Erlitou economic networks through the degree of diversity in pottery procurement. Based on the pottery

sample from the Section V and Section III (2 of the 15 site sections according to the modern roads and village plans; Section V includes the palatial enclosure and the northern part of the workshop enclosure, and Section III includes the east end of the site), recent geochemical analysis on the Erlitou pottery suggests that there were probably multiple pottery procurement and production units in the Erlitou site (Zhongguo 2014). By comparing the group of the pottery-procuring sources of the prestigious commoner households and another group of the pottery-procuring sources of the less prestigious commoner households, we can figure out whether and how differently the prestigious commoners participated in the Erlitou economic network from the less prestigious commoners; whether the prestigious commoners consistently have some specific sources while the less prestigious commoners randomly have many sources suggesting that the prestigious commoners could balance their social and economic connections to other producing households better than the less prestigious commoners, just like the Hongshan higher-status households. By comparing the group of the pottery-procuring sources of the prestigious commoner households in the palatial enclosure and another group of the pottery-procuring sources of the prestigious commoner households in the workshop enclosure, we can find whether and how differently the prestigious commoners in the palatial enclosure participated in the Erlitou economic networks from the prestigious commoners in the workshop enclosure. The study on the participation of Erlitou commoners in the economic networks will help us understand how the prestigious Erlitou commoners maintained their prestige by their links and connections to other producing commoners although they did not much participate in production.

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